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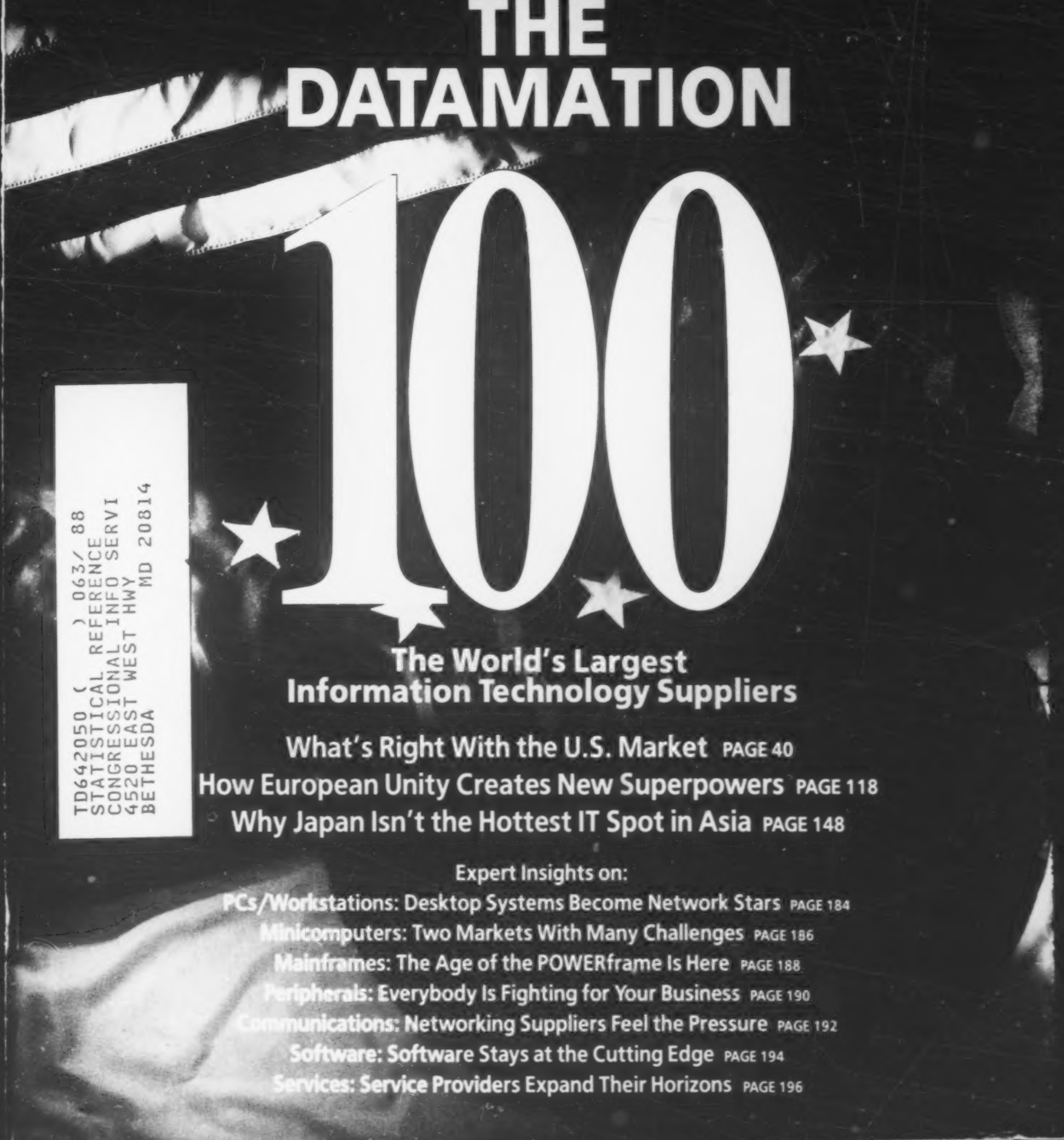
Sales of the Industry's Top Suppliers Soar to $255.8 Billion PAGE 22

DATAMATION

FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE



THE DATAMATION 100

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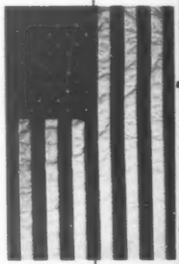

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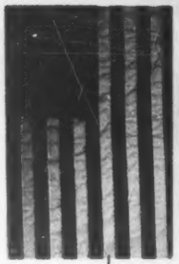
THE DATAMATION 100



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BY STEVE PAUL May in New England is a wonderful time of year. Spring is in the air, April showers give way to flowers, and the DATAMATION 100 is about to bloom with a lot of help from some cutting-edge technology.

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INSIDE DATAMATION

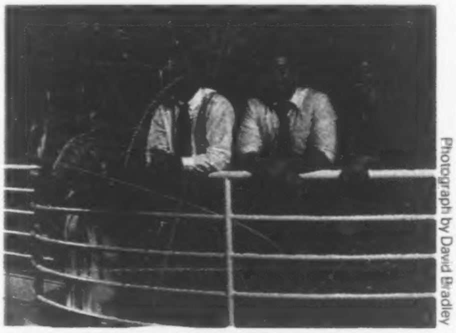
The Best of the Best

This issue of DATAMATION is about as close as the magazine can get to functioning in the way communications theorist Marshall McLuhan foresaw years ago when he said: "The medium is the message."

The medium before you is a vastly different one than the DATAMATION you usually see because its message is so exceptional: Fundamental changes are sweeping through the world's $256 billion information technology industry at a faster rate and in broader measure than at any time in its history. Technologically, the client/server model of distributed computing is reshaping the balance of power among suppliers. Geographically, the economic strength of Western Europe is overpowering the United States as an IS market. Financially, the boundaries between suppliers are blurring rapidly as superpowers seed the industry with money and seek new sources of innovation.

Fittingly, this issue of DATAMATION carries twice as many editorial pages as the average issue; four times the number of authors (writers and contributors); easily five times as much information on suppliers; and at least 20 times the number of statistics. The volume of such information and the precision required in handling it place inordinate demands on the final messengers of this medium—the managing editor, production editors, copy editors and art directors of DATAMATION. These are folks whose faces you rarely see, but they deserve as much credit as the writers and editors whose visages you're accustomed to seeing on this page.

Managing editor Steve Paul commanded the DATAMATION 100 issue from start to finish. Working with international editor Marsha Johnston, project leader Joe Kelly and research manager Brandt Brito, Paul coordinated the gathering of financial and other information on more than 300 suppliers worldwide. Partnering with Lotus Development Corp., he developed a customized version of Lotus 1-2-3 Release 3.0 to analyze the thousands of numbers fed to DATAMATION by those suppliers.



Photograph by David Bradley

COMMANDER PAUL & TROOPS: Staiti, Greenblatt, Ovans, Lewis, Gordon, Paul, Korisky.

Collaborating with copy editing specialists Andrea Ovans, Chris Staiti and Andrea Cohen, Paul shepherded 100 supplier profiles and more through the system. Teaming with production experts C.J. Korisky and Ellen Greenblatt, he translated 1-2-3 files, MCI mail messages and countless faxes into the charts and words before you. Allying art directors Chris Lewis and David Gordon, he chose the photos and design that frame this issue.

The industry, of course, is deserving of such effort. For its top 100 suppliers to have grown by more than $10 billion in 1989 is no small achievement. In the face of so much change, this expansion sends a message in itself: The best is yet to come in information technology.

Tim Mead

Tim Mead, Editor-in-chief

DATAMATION

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Practicing What We Preach

May in New England is a wonderful time of year. Spring is in the air, April showers give way to flowers, and the DATAMATION 100 is about to bloom with a lot of help from some cutting-edge technology.

BY STEVE PAUL

I was a young man back then in the spring of '89. DATAMATION had just moved from its New York City digs to the shining corporate offices of Cahners Publishing Co. in suburban Newton, Mass., some 10 miles west of Boston.

I had just joined the DATAMATION team as managing editor, accompanied by a new copy, art and production staff. We had no sooner warmed to our PCs and called up our spell-checkers when ominous whispers of a special issue echoed among the cubes. The DATAMATION 100 was coming. We'd be sorry, the whispers said.

To us eager, fresh-faced recruits, producing a double issue as a new staff still unfamiliar with editorial and art style seemed a worthy challenge; to do it in six weeks seemed a luxury to our biweekly oriented minds. But we were young. What did we know? We were due for a quick education. . . .

Six weeks later, as the dust and data settled, we emerged older, grayer and a lot more streetwise. It was obvious that the DATAMATION 100 was a year-round project in terms of planning, preparation and design; we needed to find an easier way.

THE DTM 100 TEAM: Steve Paul (front); (l to r) Bruce Webster, Brandt Brito and Joe Kelly.

THE DATAMATION 100

After a much-needed respite, we managed to convince Joe Kelly, coconspirator with Parker Hodges for DTM 100 '89, to lead us into the '90s. We held a preliminary planning meeting in December and, with the benefit of weeks of wisdom behind us, decided to revamp almost every aspect of the project.

We realized that we hadn't fully utilized the technology in our Newton office. Each section, copy and production editor has a Wyse Technology 286 PC packed with a 40-megabyte hard drive with 1MB memory. Tying them, as well as 13 other Cahners' publications, together is a Novell Inc. local area network server—a client/server architecture in our own backyard.

We wanted to see if we could develop an application for that architecture that could do the following:

- **Access all of our DTM 100 data, which stretches back to 1984.** Previously, the data were compiled in separate dBASE III+ databases, and we wanted to combine it into in a single spreadsheet format.
- **Perform an ad hoc query**, allowing us to analyze the six years of data with almost limitless variations.
- **Format the 22 standard tables used in last year's DTM 100.** We wanted the ability to quickly retrieve and analyze key data at the touch of a button. Included would be a currency conversion capability to automatically translate foreign currencies to their dollar equivalents.
- **Provide graphics capabilities that would let us do last-minute charts and graphs from unexpected data extractions.** Specifically, we needed a program with data formats compatible with our current editorial software (Bestinfo, XyWrite) and with an alternative, backup production source, the Apple Macintosh IIcx (running Microsoft Excel, PageMaker 3.0).
- **Produce the issue more quickly**. By finding a more efficient way to create tables, charts and graphs, we could spend less time generating the data and more time thinking about its significance. This was particularly important because we were going to produce 50% more editorial material than we produced last year.
- **Enable us to distribute the data to our readers in an industry standard format.**

DATAMATION Meets Lotus

As we were in the throes of our first DTM 100, across the Charles River in Cambridge, unsuspecting programmers at Lotus Development Corp. were toiling away on version 3.0 of Lotus 1-2-3. We had been following news of the upgrade with interest. Could this be the application for us? We knew we would need a lot of help; could we convince them it would be worth their while?

To see if we could reach a mutually agreeable partnership, we arranged a meeting in early January with the Powers That Know at Lotus: Susan Earabino, public relations manager; Rich Reily senior development manager of product technical support; and Chuck Sullivan, senior product marketing manager for 1-2-3, release 3.0.

DATAMATION EDITORS learn to love spreadsheets at Lotus' lab.

Obviously, the prestige and publicity generated by a joint venture with DATAMATION would be attractive to Lotus (we hinted). And it was an opportunity to increase their visibility in the applications development field. They were hooked.

On February 1, we got down to specifics, meeting with software applications specialist Bruce Webster—the man with all the answers, we hoped. Joe Kelly was there, as was Jordan Backler, Cahners' director of editorial services and guardian of our networked environment.

Our plans turned on three major questions: Do our PCs have enough memory for this application? Would the application interfere with a sometimes temperamental network architecture? Could it all be done in six weeks?

Jordan was apprehensive, I was skeptical. Bruce was confident. I'll be back, he said, in a month. And he promised that he would magically arrive with the first run of the application he'd tested in a comparable environment at Lotus' laboratories.

Well, it was more a matter of phone calls than magic. But, true to his word, Bruce did come back in a month with the application. He installed it on an extra 286 PC that we supplied with an added megabyte of extended memory so that it could operate as our host computer. Data from our previous DATAMATION 100s were converted to 1-2-3 from dBASE III+ and stored on the hard disk; all file extracts and ad hoc queries would be generated from this site and exported onto the network for editors to review and the copy department to check. We decided to store the database on the hard drive instead of on the network to prevent any inadvertent tampering with critical financial data.

The next two weeks were spent tweaking the application. We needed to develop a conversion format to read PostScript for the Mac, as well as make a thorough check of 1984-1988 data.

Everything worked according to plan. Graphics performance was our only source of disappointment; but actually this was due more to our unrealistic expectations. DATAMATION has a very complex and illustrative chart and graph design created using drawing software packages on the Mac. The graphics package for Lotus 3.0 is good for presentation/slide purposes, but not for the more graphically sophisticated DATAMATION.

So we needed to reassess our graphics resources. By converting our Lotus .WK3 version files to .WK2, we could translate these files to PostScript with the help of Apple File Exchange, so that they could be read by the Mac. From there some files are designed into graphs and charts using Freehand from Aldus Corp. Other files are turned into tables using Aldus' PageMaker 3.0, a program I was particularly comfortable with. We then transmit all files via modem to a nearby vendor for typeset quality reproduction. (Bruce says that Lotus intends to announce an upgrade that should promise better graphics and make this step obsolete for us for next year's 100.)

March 15th was a field trip; a half-day training session at Lotus, where we met Joe Yu, Bruce Webster's accomplice in this adventure, who helped to write the application and was there for added support—technical and moral.

The first batch of 1989 financial data was entered by our crack statisticians from Cahners' Research, Brandt Brito and Kim Friend in mid-April and completed May 3rd. Data from a total of 160 companies were input to create our 1989 database.

Breaking New Ground

Now we were cooking. We soon found out about all of the bells and whistles Lotus had packed into Lotus 3.0, providing conveniences and capabilities even beyond those we had first envisioned. New, specifically to release 3.0 were:

- A fully featured program language that enabled us to control the user interface—what the screen looks like, what the prompts are—so that we could tailor the screens to our application and our staff.
- An Add-In Toolkit for 1-2-3 release 3, which let us enter our data through data entry screens that have the ability to check data for typos and otherwise validate data, as well as translate formulas (such as translating native currencies into U.S. equivalents).
- Multiple files open in memory, which let us filter all of our currency data as we entered it, automatically converting foreign currencies into dollars at the rate correct for each particular year. In this way we could enter data in foreign currencies and they could be automatically stored in dollars and also transferred to other charts and translated back into the foreign currency.
- The three-dimensional aspect of the spreadsheet, which enabled us to produce each report on a separate worksheet in the same file, letting us see all of our tables at once.
- Relational queries and joins from disk, which gave us the ability to analyze tables containing multiple years' worth of data in a multitude of ways not limited to our original conception of what we might want to know.

From an editorial, analytical, artistic and production standpoint, our cooperative venture with Lotus was quite a coup. We were able to centralize data input; analyze historical information in our networked environment and distribute that information to the whole editorial staff; make ad hoc queries to be able to follow unexpected leads quickly; and produce complicated graphic material to a consistently high standard.

I would like to thank the people of Lotus—Susan Earabino, Rich Reily, Chuck Sullivan, Bruce Webster and Joe Yu—as well as Brandt Brito and Kim Friend of Cahners Research Department. Together, we've created a resource that will benefit the industry (and my health) throughout the year and for years to come. ▭

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Scanning the DATAMATION 100

Here are some quick facts about how the industry shapes up as it enters the 1990s.

- **Composition**—62 U.S. companies (61 last year), 20 European companies (22) and 18 Asian companies (17)
- **Markets**—North American users constituted 38.6% of the global market, European users 32% and Asian users 26%
- **New Arrivals**—Black & Decker, Boeing, British Telecom, Concurrent, Conner Peripherals, Dell, Dun & Bradstreet, Ernst & Young, Everex, Intel, Kyocera, Maxtor, Mentor, Mitac, Novell, Quantum, SHL, Sligos, 3Com, Tandon
- **New Departures**—Anacomp, Atari, Dataproducts, Diebold, Emhart, Harris, McDonnell Douglas, Micropolis, Miniscribe, National Semiconductor, Sony, Zenith
- **No Longer Counted**—IS leasing companies—Atlantic Computers, Bell Atlantic, Comdisco, Continental Information Systems, Econocom, Inspectorate International, Societe Generale.
- **Fastest Climb**—SHL Systemhouse Inc.
- **Steepest Descent**—McDonnell Douglas Corp.
- **Longest Company Name**—Siemens-Nixdorf Informationssysteme AG

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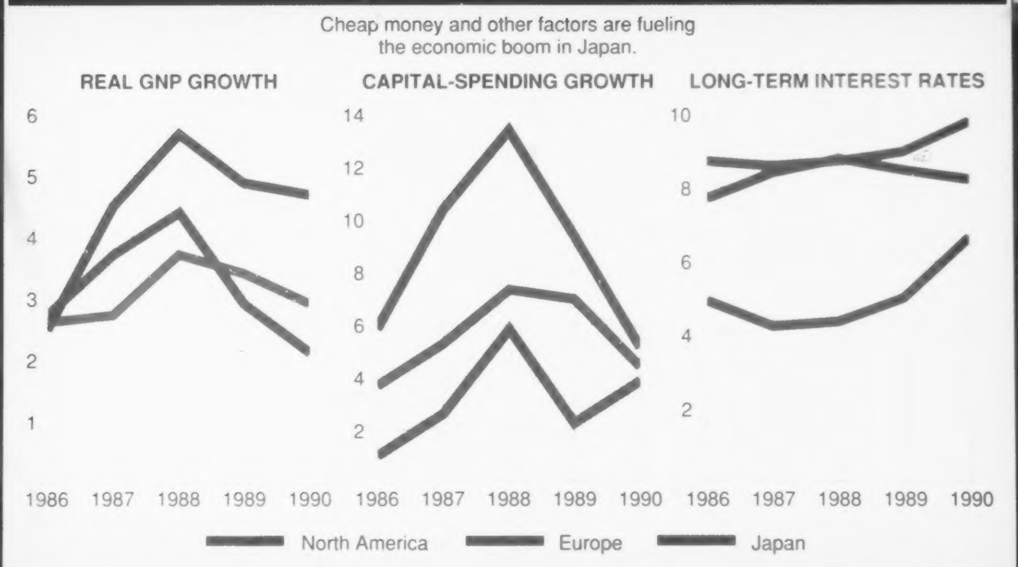
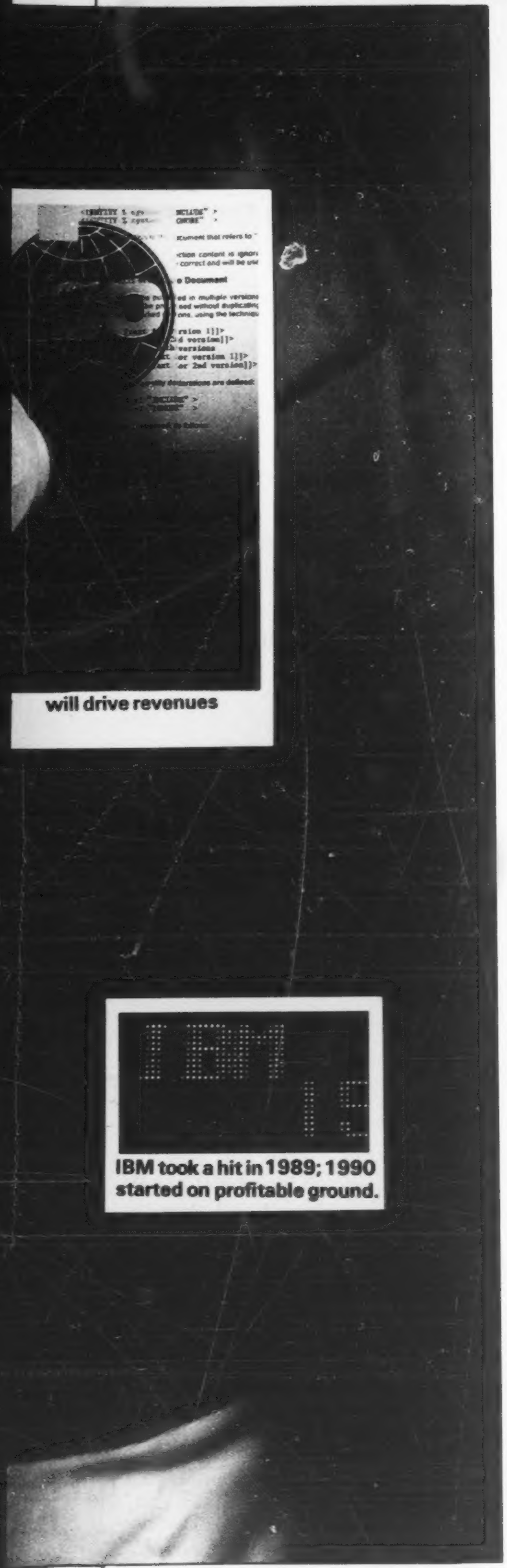
What's Driving the World Economy



Sources: International Monetary Fund and World Economic Outlook

Photograph by David Bradley

THE DATAMATION 100



will drive revenues

IBM took a hit in 1989; 1990 started on profitable ground.

The 5.2% growth in revenues from information systems and services sold by the world's top 100 suppliers in 1989 masks more significant changes afoot in the industry. Distributed computing in an open world is a far greater challenge than most realize.

Information Technology Sales Soar to $256B

The outlook for the information systems industry couldn't be brighter on the face of it. Worldwide demand for computer hardware, software, networking and services is at records levels. Revenues of the world's top suppliers reached $255.8 billion in 1989. Users identify IS as the most important factor of production for their enterprises in the 1990s. Every new system coming from the labs of IBM, Groupe Bull, NEC Corp. and the like seems to be smaller, cheaper and yet more powerful than its predecessor.

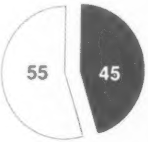
"You get so much better, well thought out technological solutions today," affirms a big customer of the industry, Merrill Lynch & Co. Inc.'s Howard Sorgen, director of information processing and technical services at the New York City-based financial giant. Adds the 31-year IS veteran: "Vendors are

BY JOSEPH KELLY

working so much harder, they are earning the business."

Underneath the surface, however, executives who manage the companies providing IS solutions see a darker, more treacherous side to the business—one fraught with change. The very things that dazzle the public and delight big users like Merrill Lynch—standards, 12-month product cycles, mainframe power on a desk, global connectivity, etc.—cause heartburn in Armonk, Paris, Tokyo and the headquarters of countless other IS suppliers.

Satisfying customers weaned on the 1980s' promise of more, more, more for less, less, less is taking its toll. And it may be even more painful as the pace of change in the industry accelerates throughout the 1990s.



Only 45 DTM 100 companies report IS as 100% of their total revenue.

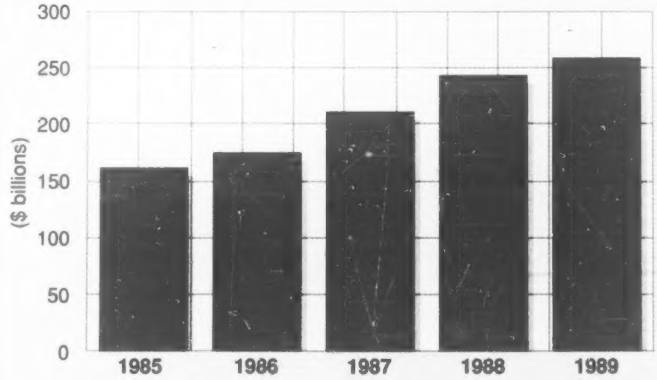
A Lackluster Financial Performance

The price exacted by achieving customer satisfaction is evident on the top line and the bottom line of the collective financial results posted by the world's top suppliers that constitute the DATAMATION 100. IS revenues for these companies grew just 5.2% in 1989, which is less than one-third of the growth rate of the last two years. Clearly, a number of companies weren't delivering as many new solutions as they needed to satisfy users or to keep up with rivals. Witness the decline in virtually flat growth at Unisys Corp. and NCR Corp. over the last two years.

Those suppliers that shipped hardware and software components of the client/server model of distributed computing—or serviced it by way of networking or systems integration—had no trouble growing in 1989. For example, Sun Microsystems Inc. increased its sales 40% to $2.1 billion by solving users' needs for high-performance networked computing based on reduced instruction set computing (RISC) and industry standard (UNIX) software. Bull added more than $1 billion to its IS revenues, which reached $6.5 billion, by acquiring Zenith Data Systems Corp., whose MS-DOS, OS/2 and UNIX desktop systems and portable computers fit the model. The networking arm of Japan's giant communications monopoly, Nippon Telegraph and Telephone Corp. (NTT), expanded its business 32% to $2.3 billion on the strength of its ability to integrate superservers, new technologies and standards.

The World's Biggest Industrial Market Expands

Revenues for the DTM 100 have grown nearly $100 billion in five years.



Foreign Exchange

Values of foreign currency (equivalent to one dollar) used in this year's DTM 100*

AUSTRALIA	$A1.2648
AUSTRIA	S13.2305
BELGIUM	BF39.3996
CANADA	C$1.1840
DENMARK	DKr7.3100
EUROPEAN CURRENCY	ECU0.9082
FINLAND	Mk4.2881
FRANCE	Fr6.3801
ITALY	L1371.6871
JAPAN	¥137.9741
NETHERLANDS	G2.1209
NORWAY	NKr6.9033
SOUTH KOREA	W665.1686
SPAIN	Pta118.3978
SWEDEN	Shr6.4462
SWITZERLAND	SFr1.6355
TAIWAN	NT$26.2783
UNITED KINGDOM	£0.6114
WEST GERMANY	DM1.8800

*OECD average exchange rates

Overshadowing such positive results, however, was the negative financial performance of several of the industry's leaders in 1989. Although earnings disappointments are de rigueur in information technology, the litany of companies reporting disappointing results in net income for 1989 reads like a *Who's Who* of the business: IBM—down 35%; Digital Equipment Corp.—down 28%; Amdahl Corp.—down 30%; etc. Even in Europe, where demand for IS is running at peak levels, Ing. C. Olivetti & Co. SpA suffered a 43% decline in earnings to L202.8 billion ($147.3 million). Only the highly diversified Japanese suppliers reported consistently good profit performance.

Where did the profits go? In part, they went into restructuring costs and stock buy-backs, which totaled some $5 billion among U.S. companies. IBM topped everyone in this regard, taking a $2.3 billion charge against its fourth-quarter 1989 earnings to cover the cost of plant closings and early retirements.

But, mainly, profits just disappeared into operating margins, the difference between what it costs a supplier to create a product or service and what that product or service sells for. The systems that are spurring industry growth today—personal computers and workstations—command lower margins than other technologies. Although the economics of distributed systems was known to supplier executives for some time, the pace of this economic revolution caught most off guard. "The speed of the shift surprised us," admits James A. Unruh, who has taken over for Michael Blumenthal as chairman and chief executive officer of Unisys Corp. How surprised was the Blue Bell, Pa.-based company? It lost $639 million in 1989, despite realizing IS sales of nearly $9.4 billion.

The margin squeeze affects even those suppliers that figured out early on that users were going to demand standards-based distributed-computing platforms in the 1990s. Hewlett-Packard Co., despite growing its IS revenues 24% to $7.8 billion in 1989, didn't make as much money on its systems as it had in previous years. Gross margins for the Palo Alto computer maker dropped from 52.2% in 1987 to 48.8% in 1989. They'll sink even further in the future to 46.1%, estimates Sanford C. Bernstein & Co., an investment research and management firm in New York City.

Even if traditional minicomputer suppliers like HP are able to adjust to somewhat lower profit margins, it's unclear just how far they can go to compete against companies that do nothing but offer standards-based solutions on desktop platforms. "We are profitable on 30% gross margins," points out Thomas Yuen, cochairman of AST Research Inc., the $482 million PC maker in Irvine, Calif. "While it may be technically feasible for minicomputer manufacturers to move their products downward, financially it will be difficult for them to do so." He cites Digital as an example. If the world's No. 2 computer maker tried to realize one-fourth of its revenues from servicing PCs as it does today in minicomputers, Yuen says, Digital would be out of business. "Old habits are hard to break," Yuen says of the minicomputer companies' plight.

Wall Street Winds Down

As if adapting to the new economics of distributed computing weren't enough of a challenge for suppliers, they must also cope with flat U.S. demand for new systems and services.

Divining the reasons for the slowdown in U.S. spending on IS is a topic of conversation at virtually every industry gathering. To some, it's due to undersupply of critical technology (See "What's Right with the U.S. Market," p. 38.) To others, it's a natural consequence of a market that has just run out of gas after accelerating 15% annually in the late 1970s and early 1980s. U.S. spending on high technology (everything from computers to copiers) peaked in 1985 as a percentage of capital spending and will continue to be a smaller share of the overall capital investment, maintains Stephen S. Roach, chief economist at the Big Apple investment house Morgan Stanley & Co. Inc.

One of the big culprits in the spending slowdown is the financial services industry. Investment banks, commercial banks, savings and loan institutions, insurance companies and real estate enterprises displayed an almost insatiable appetite for IS during the bull market of the 1980s. But the stock market crash of 1987, the fall in real-estate values (and hence mortgage loans) in the Southwest and Northeast, natural disasters and other events have sharply curbed Wall Street's and Main Street's hunger for computers. In fact, many are consolidating—not expanding—their IS operations. Merrill Lynch & Co. Inc. is a case in point; the firm is reducing the number of its data centers from seven to two.

Merrill Lynch and other big IS customers are demanding that suppliers reduce or at least govern the total cost of using information systems—not just the hardware component. Operations support, the cost of real estate and facilities, salaries for programmers maintaining old programming code—all of that is rising, not declining. Until suppliers help cut those costs, sales of hardware to U.S. sites will remain depressed. "The market is responsive to total solution price/performance," says Don Young, a securities analyst for Bernstein. "Mainframe IS staffs are developing, supporting and operating systems in the same way they did five years ago. And the systems are getting more complicated, involving more resources to implement."

Fast Trackers

The companies that grew the most in 1989

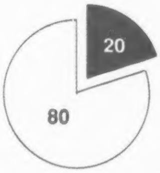
	1989 RANK	COMPANY	IS REV. IN LOCAL CURRENCY 1989	1988	% INCREASE
1	71	SHL*	C$639.1	C$240.0	166.3%
2	80	Ernst & Young*	$450.0	$178.0	152.8%
3	91	Quantum	$394.2	$172.5	128.5%
4	79	Dun & Bradstreet*	$450.0	$200.0	125.0%
5	57	Oracle	$769.3	$394.9	94.8%
6	97	Kyocera	¥50,554.0	¥33,126.8	52.6%
7	93	Dell	$388.6	$257.8	50.7%
8	65	American Express*	$660.0	$446.9	47.7%
9	24	NTT	¥311,000.0	¥217,086.1	43.3%
10	85	Mentor	$426.4	$300.8	41.8%

* Growth partly due to merger or major acquistion
All revenue figures are in millions.

Although IS suppliers have responded to the rising support costs faced by their customers with new products and services, their full effect won't be felt by vendors for some time. Improvements to large-scale computer operating systems (like automating storage management) and to programming (like computer-aided software engineering tools) won't begin to significantly raise demand for big systems until middecade.

Until CASE and other tools really take hold, however, suppliers are resorting to the only other alternative available for keeping the cost of computing low: heavy discounts on new systems. Users of large-scale systems, midrange systems and workstations are typically getting 15%-off list price deals from suppliers. Such aggressive pricing can, in some cases, spur significantly heightened demand from users. In 1989 IBM, for example, saw its U.S. sales climb for the first time since 1985—thanks, in part, to extremely aggressive mainframe pricing.

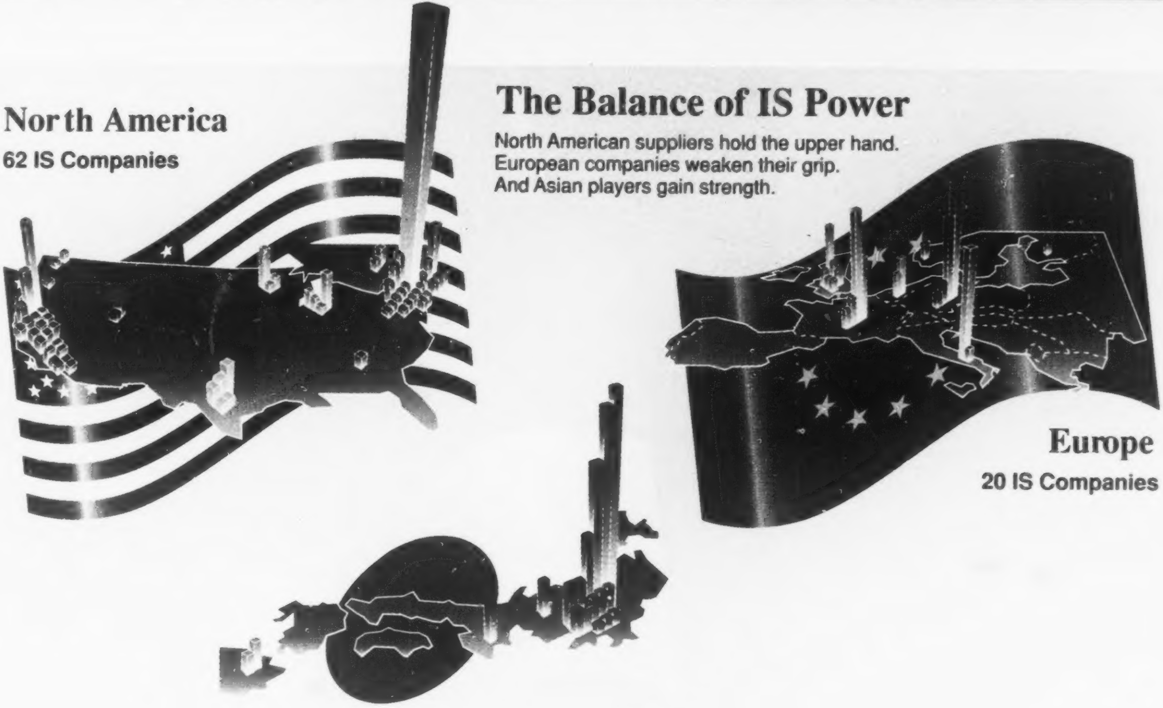
For most of the IS industry, the strategy for future growth is to switch to systems built around standards—whether the commonly accepted operating



There are 20 new entrants in the 1989 DTM 100.

The Balance of IS Power

North American suppliers hold the upper hand. European companies weaken their grip. And Asian players gain strength.



North America
62 IS Companies

Europe
20 IS Companies

Asia
18 IS Companies

Rank	Company	Location	Total Rev.
	NORTH AMERICA		
	CANADA		
47	Northern Telecom	Mississauga	1,150.0
71	SHL Systemhouse	Ottawa	539.8
	UNITED STATES		
	EAST COAST		
1	IBM	Armonk, NY	60,805.0
2	Digital	Maynard, MA	12,936.7
5	Unisys	Blue Bell, PA	9,390.0
17	AT&T	New York City	2,865.0
20	Xerox	Stamford, CT	2,790.0
21	Wang	Lowell, MA	2,697.0
36	ADP	Roseland, NJ	1,689.5
39	Prime	Natick, MA	1,520.0
43	Data General	Westborough, MA	1,296.5
44	CA	Garden City, NY	1,290.1
51	Commodore	West Chester, PA	866.5
58	General Electric	Fairfield, CT	740.0
63	Black & Decker	Towson, MD	687.6
65	American Express	New York City	660.0
70	Lotus	Cambridge, MA	556.0
73	Martin Marietta	Bethesda, MD	502.2
74	NYNEX	White Plains, NY	495.0
79	Dun & Bradstreet	New York City	450.0
80	Ernst & Young	New York City	450.0
82	Kodak	Rochester, NY	445.0
92	Shared Medical	Malvern, PA	390.0
100	Concurrent	Tinton Falls, NJ	344.6
	MIDWEST		
12	NCR	Dayton, OH	5,319.0
35	Control Data	Bloomington, MN	1,691.0
38	TRW	Cleveland	1,643.0
45	Andersen	Chicago	1,225.7
53	Motorola	Schaumburg, IL	860.0
56	Cray	Minneapolis	784.7
61	3M	St. Paul	696.4
	SOUTH		
52	Intergraph	Huntsville, AL	860.1
	SOUTHWEST		
16	Compaq	Houston	2,876.1
23	EDS	Dallas	2,477.9
31	Tandy	Fort Worth	1,892.0
67	TI	Dallas	585.0
93	Dell	Austin, TX	388.6
	WEST		
49	Storagetek	Louisville, CO	982.5
84	Novell	Provo, UT	429.9
	WEST COAST		
7	Hewlett-Packard	Palo Alto	7,800.0
11	Apple	Cupertino, CA	5,372.3
26	Amdahl	Sunnyvale, CA	2,101.0
27	Sun	Mountain View, CA	2,062.5
34	Seagate	Scotts Valley, CA	1,797.0
37	Tandem	Cupertino, CA	1,676.8
41	CSC	El Segundo, CA	1,442.8
50	Microsoft	Redmond, WA	952.8
55	Intel	Santa Clara	812.0
57	Oracle	Belmont, CA	769.3
60	Conner	San Jose	704.9
66	Lockheed	Calabasas, CA	590.0
76	AST Research	Irvine, CA	482.0
77	Science App.	San Diego	479.0
78	Wyse	San Jose	452.3
81	Maxtor	San Jose	447.2
85	Mentor	Beaverton, OR	426.4
87	3COM	Santa Clara	413.9
88	Everex	Fremont, CA	402.0
90	MAI Basic Four	Tustin, CA	397.0
91	Quantum	Milpitas, CA	394.2
96	Tandon	Moorpark, CA	377.9
98	Boeing	Bellevue, WA	359.2
	THE FAR EAST		
	JAPAN		
3	NEC	Tokyo	11,480.4
4	Fujitsu	Tokyo	11,378.9
6	Hitachi	Tokyo	8,719.0
13	Toshiba	Tokyo	4,595.1
14	Canon	Tokyo	3,783.3
15	Matsushita	Osaka	3,663.7
24	NTT	Tokyo	2,254.0
25	Nihon Unisys	Tokyo	2,112.7
29	Mitsubishi	Tokyo	2,025.7
30	Oki	Tokyo	1,952.0
33	Ricoh	Tokyo	1,799.5
40	Seiko Epson	Nagano	1,449.5
42	C. Itoh	Tokyo	1,345.9
72	CSK	Tokyo	520.0
86	Alps	Tokyo	420.4
97	Kyocera	Kyoto	366.4
	TAIWAN		
75	Acer	Taipei	493.7
94	Mitac	Taipei	380.0
	EUROPE		
	UNITED KINGDOM		
22	STC	London	2,643.4
59	Amstrad	Essex	717.0
62	British Telecom	London	692.5
68	Racal	Berkshire	573.9
83	SD-Scicon	Hampshire	431.5
95	Sema Group	London	378.6
	THE NETHERLANDS		
18	NV Philips	Eindhoven	2,814.8
28	Memorex	Amsterdam	2,056.6
	FRANCE		
8	Groupe Bull	Paris	6,465.4
32	Alcatel	Paris	1,800.3
48	Cap Gemini	Paris	1,103.4
89	Sligos	Paris La Defense	400.7
	WEST GERMANY		
9	Siemens	Munich	6,010.6
19	Nixdorf	Paderborn	2,792.6
54	Mannesmann	VS-Villigen	819.1
69	Comparex	Mannheim	566.0
	SCANDINAVIA		
46	Nokia	Helsinki, Finland	1,191.9
99	Norsk Data	Oslo, Norway	358.1
	ITALY		
10	Olivetti	Ivrea	5,573.3
64	Finsiel	Rome	662.5

Revenue figures are in millions of dollars.

systems like UNIX, MS-DOS or OS/2 or industry-approved communications protocols like Open Systems Interconnect (OSI). So-called open systems will drive revenues for the majority of suppliers in the 1990s. Only IBM, Digital and some Japanese suppliers seem to have customer bases big enough to buy enough proprietary platforms to keep them growing. Anyone smaller—even those on the scale of a $5.3 billion NCR Corp. or a $5.6 billion Olivetti—must be committed to open platforms.

Open Systems Strategies for Survival

"By the time the decade is over, I would expect that most, practically all, of our users of our proprietary products will be wearing the open systems hat," predicts Charles Exley, chairman of Dayton, Ohio-based NCR.

"If we had been caught in 1989 without the transitions we have been making since 1987, it would have been a disaster for us," says Vittorio Cassoni, comanaging director of Olivetti. He's referring to the Ivrea, Italy-based company's decision three years ago to move away from proprietary systems toward open platforms. Proprietary products only generated about 10% Olivetti's 1989 system sales.

The transition to the new economics of distributed computing is affecting new product strategies in almost every corner of the industry, particularly among minicomputer makers. Most of the leading U.S. mini producers—Data General Corp, MAI Basic Four Inc., Prime Computer Inc. and Wang Laboratories Inc.—either market UNIX-based hardware or intend to do so. The switch from proprietary products is costing them, however. In 1989, DG lost $121 million; MAI $40 million; Prime $277 million; Wang $511 million. On the other side of the Atlantic, minicomputer makers had their woes too. Norsk Data AS of Norway lost $69 million.

The slowdown in the U.S. market and the squeeze on profits in 1989 led to a predictable escalation in demands for a high-tech industrial policy in the United States. Advocates of such a policy, like Intel Corp. president Andrew Grove, maintain that the U.S. system of funding technology initiatives—via money raised from venture capitalists or public stock offerings—can't compete with Japan's system. In Japan, individual companies either make long-term investments in new technology on their own or in groups in consultation with government planners—often because of economic incentives (e.g., lower interest rates) and government directives. They also enjoy much closer and friendlier ties to banks, which are themselves oriented toward the long term.

But the noise made by policy-minded U.S. executives apparently isn't reaching the White House. The Bush administration has promised only to back measures like the proposed capital gains tax cut and the relaxation of antitrust laws, which benefit companies in all industries, not just high tech. Executives do credit the administration for trying to pry open the Japanese market for big ticket items like satellites and supercomputers. However, they have only themselves to blame for the collapse of U.S. Memories, an industrial consortium proposed to keep the United States competitive in the area of memory chips.

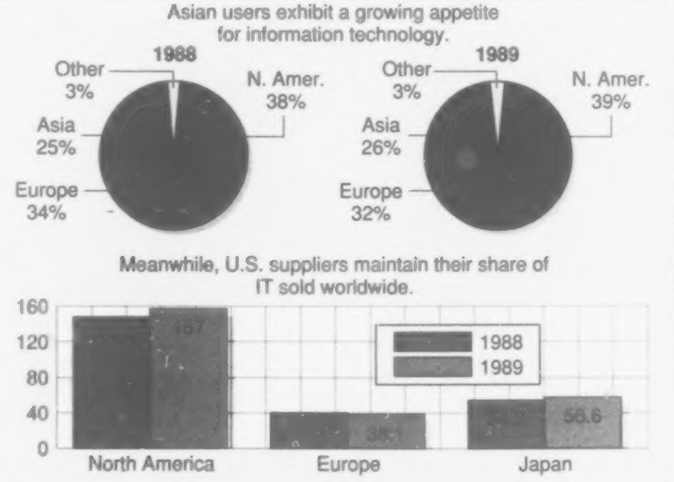
The two most important components of the IS industry, when judged on the basis of growth alone, are the software and services associated with systems. One has to look no further than the ranks of the DATAMATION 100 to see that the companies providing programs to run on computers and those integrating them are enjoying spectacular growth. For example, Electronic Data Systems Corp. of Dallas expanded its non-General Motors Corp. systems integration business 30% to nearly $2.5 billion in 1989. Cap Gemini Sogeti of Paris grew 21% to $1.1 billion on the strength of its IS services.

Software & Services Are Pivotal

There are now at least seven software or service suppliers with annual IS revenues in excess of $1 billion. Besides EDS and Cap Gemini, there are Andersen Consulting, Automatic Data Processing Inc., Computer Associates International Inc., Computer Sciences Corp. (CSC) and TRW Inc.

The biggest force in software flexed its muscles in 1989. Not only did IBM grow its software business beyond $8 billion, Big Blue also invested in several software companies—including several members of the DATAMATION 100. Notable among them was Management Science America Inc. (now part of Dun & Bradstreet Software). IBM is also increasing the number of software programmers it employs, even as it cuts back on workers in other areas.

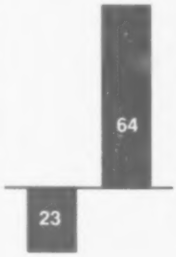
Buyers and Sellers


Asian users exhibit a growing appetite for information technology.

Meanwhile, U.S. suppliers maintain their share of IT sold worldwide.

The excitement and investment in software is by no means confined to the United States. In Europe, several other companies besides Cap Gemini are riding the software wave. Finsiel SpA of Rome and SD-Scicon PLC in Fleet, U.K., have boasted consistently strong growth rates and profitability. Even established hardware manufacturers in Europe are depending more on software and service sales. The computer division of London-based STC PLC now draws nearly half of its $860 million from these seg-

Sixty-four DTM 100 companies climbed in ranking.



Twenty-three companies took the plunge.

ments. Even Japan has caught the systems integration bug. "We are not in competition for hardware anymore," Hiroshi Yoshida, an executive with Nihon Unisys Ltd., told DATAMATION. "What clients are looking for now is personalized services and design capabilities."

But software and services have yet to give the industry the kick it needs to regain double-digit growth or attain higher profits. For instance, IBM's software revenues rose only 6.3% in 1989. Pure-play software providers even find the going unsteady: witness the less-than-stellar quarterly performances turned in by Computer Associates and Oracle. And who knows how much cutbacks in U.S. government spending will affect service companies like CSC.

Customer Focus Becomes Critical

Software and services, however, represent more than market segments. They reflect just how successful companies—particularly hardware suppliers—are at understanding customer needs and developing products to meet those needs. For a number of vendors, that means a whole new way of doing business. They have to shift the emphasis of research and development out of labs and into customer sites. They have to embark on new distribution strategies—establishing partnerships to open channels that can best deliver distributed-computing solutions to users. They have to develop global offerings that, nevertheless, can be customized region by region. In short, they have to listen not to their own employees as much as their customers.

Hearty Workers

The companies with the highest revenues per employee

	1989 RANK	COMPANY	REV. PER EMPL. ($ THOU.)	IS REV. ($ MIL.)	EMPLS.
1	59	Amstrad	622.0	1,024.4	1,647
2	91	Quantum	615.9	394.2	640
3	96	Tandon	503.9	377.9	750
4	69	Comparex	494.3	566.0	1,145
5	11	Apple	370.1	5,372.3	14,517
6	4	Fujitsu	357.2	18,073.8	50,600
7	24	NTT	322.0	2,254.0	7,000
8	57	Oracle	307.7	769.3	2,500
9	16	Compaq	302.7	2,876.1	9,500
10	51	Commodore	270.8	866.5	3,200

Long-Term Players

The companies spending the most on research

			R&D	
	1989 RANK	COMPANY	AS % OF TOT. REV.	CORP. 1989
1	24	NTT	32.2%	724.8
2	38	TRW	24.7%	1,811.5
3	56	Cray	18.3%	143.3
4	70	Lotus	17.0%	94.3
5	3	NEC	15.7%	3,681.9
6	85	Mentor	15.1%	64.5
7	50	Microsoft	15.0%	143.1
8	5	Unisys	14.3%	1,445.0
9	44	Computer Associates	13.6%	176.0
10	43	Data General	13.2%	171.6

Revenue figures are in millions of dollars.

One subject they had better lend an ear to is outsourcing. Increasingly, large users of information systems are asking service providers to assume control of some aspects of their IS operations. Outsourcing, to be profitable for users and suppliers, depends on a degree of cooperation and understanding between both; such cooperation is almost unprecedented in the history of the industry. Fools who rush into the business may find themselves drowning in red ink. Those who avoid it may find themselves out of touch with users.

When suppliers are on top of changes—such as the need for users in the 1980s to express their individuality via personal computing and the technology (microprocessors) that enabled it—they flourish. When they are in the throes of change—such as the swift movement toward distributed computing confronting suppliers today—they flounder.

"Does the data-processing industry have to start each decade with a stumble?" asked Frederic G. Withington in an article in DATAMATION 10 years ago on the subject of how the industry looked going into 1980. The analysis by Withington, a former DATAMATION adviser and consultant with Arthur D. Little Inc., would play as well today as it did in 1980. At the time, earnings for the world's top computer makers were off—including the first downturn in IBM's earnings since the early 1950s. Rising wages and other support costs were threatening suppliers' ability to deliver continued gains in the price and performance of systems.

But the similarities end there. At the start of the 1980s, the number of people who knew how to operate a computer was small. Marketing took a back seat to engineering. Customers were fed technology by computer makers. Today, there are at least a 100 million people in the world who know how to boot up a personal computer. Marketing and engineering are almost synonymous functions at most companies. And customers only want to be fed solutions—not bits and bytes.

Profitability will undoubtedly return to the IS industry. Just as the PC spurred the growth of the 1980s, there will be a new horse, or horses, to ride in the 1990s. Desktop systems based on standard platforms, networked together in client/server relationships will be the heart of corporate information management.

There will also be a new horse to ride in higher margin software and services. But the difference—and it's a big one—is who will be holding the reins. It's not the suppliers anymore, it's the customers—you. ▭

Joseph Kelly, a contributing editor based in New York City, comanaged the DATAMATION 100 project.

THE DATAMATION 100

1989 WORLD RANK	1988 WORLD RANK	COMPANY	1989 IS REVENUE	1988 IS REVENUE	IS REV. % CHANGE	1989 TOTAL REVENUE	IS AS % OF TOTAL REVENUE
1	1	IBM	60,805.0	55,002.8	10.5%	62,710.0	97.0%
2	2	Digital	12,936.7	12,284.7	5.3%	12,936.7	100.0%
3	4	NEC	11,480.4	10,475.7	9.6%	23,388.9	49.1%
4	3	Fujitsu	11,378.9	10,999.1	3.5%	18,073.8	63.0%
5	5	Unisys	9,390.0	9,133.0	2.8%	10,097.0	93.0%
6	6	Hitachi	8,719.0	8,247.6	5.7%	49,064.3	17.8%
7	7	Hewlett-Packard	7,800.0	6,300.0	23.8%	11,899.0	65.6%
8	11	Groupe Bull	6,465.4	5,296.7	22.1%	6,465.4	100.0%
9	8	Siemens	6,010.6	5,951.0	1.0%	32,514.9	18.5%
10	9	Olivetti	5,573.3	5,427.9	2.7%	6,583.9	84.7%
11	12	Apple	5,372.3	4,434.1	21.2%	5,372.3	100.0%
12	10	NCR	5,319.0	5,324.0	-0.1%	5,956.0	89.3%
13	13	Toshiba	4,595.1	4,226.6	8.7%	28,896.7	15.9%
14	15	Canon	3,783.3	3,391.6	11.5%	9,791.1	38.6%
15	14	Matsushita	3,663.7	3,441.0	6.5%	40,877.4	9.0%
16	24	Compaq	2,876.1	2,065.6	39.2%	2,876.1	100.0%
17	21	AT&T	2,865.0	2,445.0	17.2%	36,112.0	7.9%
18	19	NV Philips	2,814.8	2,794.6	0.7%	26,981.0	10.4%
19	18	Nixdorf	2,792.6	3,044.9	-8.3%	2,792.6	100.0%
20	20	Xerox	2,790.0	2,650.0	5.3%	17,635.0	15.8%
21	17	Wang	2,697.0	2,918.9	-7.6%	2,697.0	100.0%
22	22	STC	2,643.4	2,425.1	9.0%	4,264.6	62.0%
23	27	EDS	2,477.9	2,007.1	23.5%	5,466.8	45.3%
24	32	NTT	2,254.0	1,694.0	33.1%	2,254.0	100.0%
25	25	Nihon Unisys	2,112.7	2,057.7	2.7%	2112.7	100%
26	28	Amdahl	2,101.0	1,802.0	16.6%	2,101.0	100.0%
27	37	Sun	2,062.5	1,461.6	41.1%	2,062.5	100.0%
28	23	Memorex	2,056.6	2,078.5	-1.1%	2,056.6	100.0%
29	44	Mitsubishi	2,025.7	1,973.0	2.7%	21,032.9	9.6%
30	36	Oki	1,952.0	1,761.0	10.8%	3,858.1	50.6%
31	29	Tandy	1,892.0	1,792.4	5.6%	4,285.7	44.1%
32	31	Alcatel	1,800.3	1,716.0	4.9%	14,086.1	12.8%
33	30	Ricoh	1,799.5	1,727.5	4.2%	5,880.8	30.6%
34	40	Seagate	1,797.0	1,351.0	33.0%	1,797.0	100.0%
35	16	Control Data	1,691.0	2,538.0	-33.4%	2,934.5	57.6%
36	33	ADP	1,689.5	1,617.0	4.5%	1,689.5	100.0%
37	38	Tandem	1,676.8	1,424.7	17.7%	1,676.8	100.0%
38	26	TRW	1,643.0	1,611.0	2.0%	7,340.4	22.4%
39	34	Prime	1,520.0	1,594.0	-4.6%	1,520.0	100.0%
40	35	Seiko Epson	1,449.5	1,487.7	-2.6%	N/A	N/A
41	45	CSC	1,442.8	1,253.4	15.1%	1,442.8	100.0%
42	51	C. Itoh	1,345.9	1,154.0	16.6%	120,856.7	1.1%
43	42	Data General	1,296.5	1,330.5	-2.6%	1,296.5	100.0%
44	55	Computer Associates	1,290.1	925.3	39.4%	1,290.1	100.0%
45	49	Andersen Consulting	1,225.7	945.2	29.7%	1,442.0	85.0%
46	50	Nokia	1,191.9	1,165.1	2.3%	5,315.9	22.4%
47	56	Northern Telecom	1,150.0	900.0	27.8%	6,105.5	18.8%
48	53	Cap Gemini	1,103.4	976.5	13.0%	1,103.4	100.0%
49	58	StorageTek	982.5	883.7	11.2%	982.5	100.0%
50	66	Microsoft	952.8	718.6	32.6%	952.8	100.0%

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DATAMATION
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1989 EMPLOYEES	% EMPL. CHANGE FROM 1988	IS REV. PER EMPL. ($ THOU.)	R&D		NET INCOME	% RETURN ON SALES	FISCAL YEAR END
			CORP. 1989	AS % OF TOT. REV.			
383,220	-1.0%	163.6	6,827.0	10.9%	3,758.0	6.0%	December
125,900	1.2%	102.8	1,580.7	12.2%	875.8	6.8%	June
116,890	10.8%	200.1	3,681.9	15.7%	518.9	2.2%	March
50,600	-46.6%	357.2	1,856.9	10.3%	623.1	3.4%	March
82,300	-11.5%	122.7	1,445.0	14.3%	-639.0	-6.3%	December
290,000	80.1%	169.2	2,915.8	5.9%	1,463.3	3.0%	March
95,000	9.2%	125.3	1,273.0	10.7%	829.0	7.0%	December
47,332	3.9%	136.6	580.2	9.0%	-41.8	-0.6%	December
365,000	3.4%	89.1	3,656.9	11.2%	838.8	2.6%	September
56,937	-1.1%	115.6	348.5	5.3%	147.3	2.2%	December
14,517	34.0%	370.1	416.4	7.8%	438.4	8.2%	September
56,000	-6.7%	106.4	446.0	7.5%	412.0	6.9%	December
142,000	10.1%	203.5	1,667.0	5.8%	935.0	3.2%	August
41,000	0.6%	238.8	637.8	6.5%	282.1	2.9%	December
193,088	43.9%	211.7	2,377.6	5.8%	1,570.1	3.8%	March
95,00	58.3%	302.7	132.5	4.6%	333.3	11.6%	December
283,500	-6.8%	127.4	2,652.0	7.3%	2,697.0	7.5%	December
304,800	-1.8%	88.5	2,148.6	8.0%	647.8	2.4%	December
31,037	0.0%	90.0	271.3	9.7%	N/A	0.0%	December
111,400	11.3%	158.3	809.0	4.6%	704.0	4.0%	December
N/A	N/A	N/A	243.4	9.0%	-511.0	-18.9%	June
36,393	7.5%	117.2	443.7	10.4%	288.2	6.8%	December
57,200	13.5%	95.6	N/A	0.0%	435.3	8.0%	December
7,000	-97.5%	322.0	724.8	32.2%	23.5	1.0%	March
8,181	6.1%	261.4	N/A	N/A	34.1	1.6%	March
8,200	0.0%	256.2	277.0	13.2%	153.0	7.3%	December
10,560	28.0%	195.3	265.4	12.9%	36.1	1.8%	June
9,993	-24.0%	205.8	28.9	1.4%	-54.2	-2.6%	March
89,500	18.1%	235.0	1,050.9	5.0%	488.5	2.3%	March
18,440	-1.2%	209.2	304.4	7.9%	96.7	2.5%	N/A
38,000	2.7%	112.8	N/A	0.0%	303.9	7.1%	June
121,000	-4.7%	116.4	1,479.9	10.5%	526.3	3.7%	December
34,385	4.2%	171.0	336.8	5.7%	157.6	2.7%	March
40,880	57.2%	44.0	67.8	3.8%	104.7	5.8%	June
18,000	-46.5%	163.0	289.2	9.9%	-680.4	-23.2%	December
20,500	-6.8%	82.4	87.9	5.2%	196.2	11.6%	June
9,790	11.9%	171.3	214.6	12.8%	117.8	7.0%	September
74,280	1.5%	98.8	1,811.5	24.7%	263.0	3.6%	December
10,670	-14.6%	142.5	173.2	11.4%	-276.8	-18.2%	December
N/A	N/A	N/A	0.0	N/A	0.0	N/A	December
21,100	6.6%	68.4	0.0	0.0%	58.4	4.0%	March
N/A	N/A	N/A	N/A	0.0%	N/A	0.0%	March
13,015	-12.1%	99.6	171.6	13.2%	-120.7	-9.3%	September
6,500	1.6%	198.5	176.0	13.6%	133.2	10.3%	March
18,000	1.1%	80.1	N/A	0.0%	N/A	0.0%	August
41,326	-7.3%	128.6	268.7	5.1%	36.4	0.7%	December
47,572	-5.1%	128.3	729.8	12.0%	354.1	5.8%	December
13,500	12.5%	81.7	73.7	6.7%	N/A	0.0%	December
9.300	4.5%	105.6	85.7	8.7%	47.7	4.9%	December
N/A	N/A	N/A	143.1	15.0%	210.5	22.1%	June

THE DATAMATION 100

1989 WORLD RANK	1988 WORLD RANK	COMPANY	1989 IS REVENUE	1988 IS REVENUE	IS REV. % CHANGE	1989 TOTAL REVENUE	IS AS % OF TOTAL REVENUE
51	54	Commodore	866.5	926.1	-6.4%	866.5	100.0%
52	60	Intergraph	860.1	800.2	7.5%	860.1	100.0%
53	61	Motorola	860.0	790.0	8.9%	9,620.0	8.9%
54	63	Mannesmann	819.1	779.0	5.2%	986.7	83.0%
55	129	Intel	812.0	650.0	24.9%	3,127.0	26.0%
56	64	Cray	784.7	756.3	3.8%	784.7	100.0%
57	90	Oracle	769.3	394.9	94.8%	769.3	100.0%
58	68	General Electric	740.0	675.0	9.6%	54,574.0	1.4%
59	59	Amstrad	717.0	841.8	-14.8%	1,024.4	70.0%
60	N/A	Conner Peripherals	704.9	N/A	N/A	704.9	100.0%
61	75	3M	696.4	588.0	18.4%	11,990.0	5.8%
62	N/A	British Telecom	692.5	N/A	N/A	19,475.0	3.6%
63	80	Black & Decker	687.6	508.9	35.1%	3,190.3	21.6%
64	78	Finsiel	662.5	545.4	21.5%	662.5	100.0%
65	86	American Express	660.0	446.9	47.7%	25,047.0	2.6%
66	72	Lockheed	590.0	620.0	-4.8%	9,891.0	6.0%
67	76	Texas Instruments	585.0	577.0	1.4%	6,521.9	9.0%
68	77	Racal	573.9	554.1	3.6%	2,894.0	19.8%
69	73	Comparex	566.0	614.5	-7.9%	566.0	100.0%
70	82	Lotus	556.0	468.5	18.7%	556.0	100.0%
71	N/A	SHL	539.8	195.0	176.9%	539.8	100.0%
72	69	CSK	520.0	466.6	11.4%	520.0	100.0%
73	65	Martin Marietta	502.2	743.4	-32.4%	5,796.2	8.7%
74	88	NYNEX	495.0	430.0	15.1%	13,211.0	3.7%
75	92	Acer	493.7	379.4	30.1%	698.1	70.7%
76	83	AST Research	482.0	459.0	5.0%	482.0	100.0%
77	91	Science Applications	479.0	386.0	24.1%	1,020.0	47.0%
78	81	Wyse	452.3	456.6	-0.9%	452.3	100.0%
79	146	Dun & Bradstreet	450.0	200.0	125.0%	4,322.0	10.4%
80	107	Ernst & Young	450.0	178.0	152.8%	3,900.0	11.5%
81	103	Maxtor	447.2	339.0	31.9%	447.2	100.0%
82	100	Kodak	445.0	350.0	27.1%	18,398.0	2.4%
83	95	SD-Scicon	431.5	366.4	17.8%	463.4	93.1%
84	111	Novell	429.9	306.8	40.1%	429.9	100.0%
85	112	Mentor	426.4	300.8	41.8%	426.4	100.0%
86	62	Alps	420.4	526.7	-20.2%	2,899.1	14.5%
87	108	3Com	413.9	309.9	33.6%	413.9	100.0%
88	113	Everex	402.0	329.9	21.9%	402.0	100.0%
89	101	Sligos	400.7	343.1	16.8%	400.7	100.0%
90	87	MAI Basic Four	397.0	443.3	-10.4%	397.0	100.0%
91	N/A	Quantum	394.2	172.5	128.5%	394.2	100.0%
92	93	Shared Medical	390.0	378.7	3.0%	390.0	100.0%
93	128	Dell	388.6	257.8	50.7%	388.6	100.0%
94	114	Mitac	380.0	293.3	29.6%	380.0	100.0%
95	94	Sema Group	378.6	375.1	0.9%	479.2	79.0%
96	109	Tandon	377.9	309.3	22.2%	377.9	100.0%
97	127	Kyocera	366.4	258.5	41.7%	2,454.8	14.9%
98	119	Boeing	359.2	274.0	31.1%	20,276.0	1.8%
99	85	Norsk Data	358.1	450.2	-20.5%	358.1	100.0%
100	102	Concurrent	344.6	342.0	0.8%	344.6	100.0%

N/A = Not available or not applicable
Revenue figures are in millions of dollars.

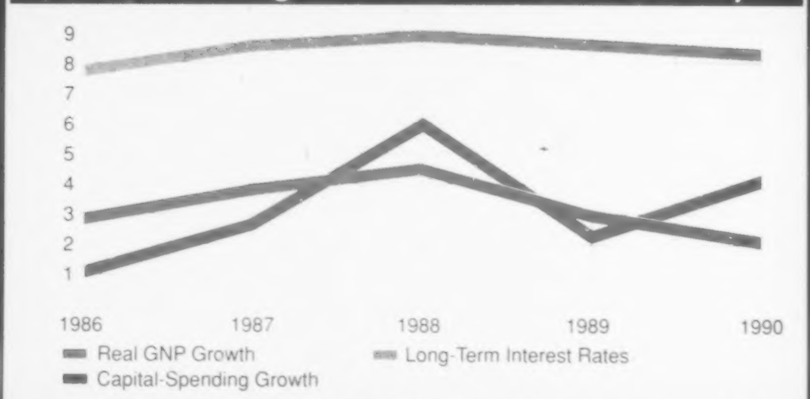
THE DATAMATION 100

1989 EMPLOYEES	% EMPL. CHANGE FROM 1988	IS REV. PER EMPL. ($ THOU.)	R&D CORP. 1989	R&D AS % OF TOT. REV.	NET INCOME	% RETURN ON SALES	FISCAL YEAR END
3,200	-5.3%	270.8	23.5	2.7%	8.3	1.0%	June
8,200	12.3%	104.9	91.4	10.6%	79.5	9.2%	December
104,000	2.0%	92.5	784.0	8.1%	498.0	5.2%	December
N/A	N/A	N/A	N/A	0.0%	N/A	0.0%	December
22,000	5.8%	142.1	365.1	11.7%	391.0	12.5%	December
4,708	-10.1%	166.7	143.3	18.3%	89.0	11.3%	December
2,500	-16.2%	307.7	73.0	9.5%	97.7	12.7%	May
292,000	-2.0%	186.9	3,931.0	7.2%	12,900.0	23.6%	December
1,647	0.2%	622.0	N/A	0.0%	125.3	12.2%	June
5,200	N/A	135.6	39.7	5.6%	41.5	5.9%	December
87,500	6.2%	137.0	784.0	6.5%	1,244.0	10.4%	December
244,418	N/A	79.7	367.2	1.9%	2,767.4	14.2%	April
38,600	17.0%	82.7	N/A	0.0%	30.0	0.9%	December
5,459	11.1%	121.4	29.9	4.5%	12.5	1.9%	December
107,542	7.5%	232.9	N/A	0.0%	1,157.0	4.6%	December
82,500	-5.0%	119.9	N/A	0.0%	2.0	0.0%	December
73,854	-1.5%	88.3	506.0	7.8%	252.8	3.9%	December
33,700	5.3%	85.9	202.8	7.0%	N/A	0.0%	March
1,145	1.6%	494.3	N/A	0.0%	17.0	3.0%	December
2,806	9.5%	198.1	94.3	17.0%	68.0	12.2%	December
3,148	21.2%	171.5	N/A	0.0%	12.9	2.4%	August
5,518	-0.7%	94.2	44.4	8.5%	30.7	5.9%	September
65,500	-3.0%	88.5	191.6	3.3%	306.9	5.3%	December
95,400	-2.1%	138.5	218.4	1.7%	808.0	6.1%	December
5,540	9.2%	126.0	665.0	95.3%	151.0	21.6%	December
2,302	13.7%	209.4	16.4	3.4%	11.4	2.4%	June
11,500	16.4%	88.7	4.6	0.5%	30.3	3.0%	February
3,000	-6.3%	150.8	32.5	7.2%	-21.2	-4.7%	March
70,000	1.4%	61.7	N/A	0.0%	586.0	13.6%	September
N/A	N/A	55.7	N/A	0.0%	N/A	0.0%	December
4,400	37.5%	101.6	N/A	0.0%	13.9	3.1%	March
137,750	-5.2%	133.6	1,253.0	6.8%	529.0	2.9%	December
5,400	-1.8%	85.8	N/A	0.0%	5.1	1.1%	December
1,812	5.0%	237.3	42.9	10.0%	52.6	12.2%	October
2,500	47.1%	170.6	64.5	15.1%	45.5	10.7%	December
N/A	N/A	N/A	11.6	0.4%	3.6	0.1%	March
1,880	20.4%	220.2	42.5	10.3%	25.4	6.1%	May
2,200	22.2%	182.7	22.8	5.7%	22.7	5.6%	July
4,032	N/A	99.4	19.7	4.9%	21.0	5.2%	December
3,700	-13.7%	107.3	10.0	2.5%	-40.0	-10.1%	September
640	16.4%	615.9	23.3	5.9%	41.3	10.5%	March
3,903	1.1%	99.9	34.4	8.8%	23.1	5.9%	December
1,508	25.7%	257.7	16.9	4.3%	5.1	1.3%	February
N/A	N/A	N/A	13.3	3.5%	23.0	6.1%	December
6,500	1.6%	73.7	N/A	0.0%	16.8	3.5%	December
750	-49.5%	503.9	10.9	2.9%	-4.3	-1.1%	December
19,242	56.4%	127.6	95.3	3.9%	214.9	8.8%	March
164,546	7.5%	123.2	754.0	3.7%	973.0	4.8%	December
2,941	-29.4%	121.8	36.2	10.1%	-60.4	-16.9%	December
3,090	-10.4%	111.5	40.3	11.7%	-13.3	-3.9%	June

Banks and other financial institutions still are big IT spenders.

If U.S. workers aren't properly educated, employers may be forced to rely more on IT.

What's Driving the North American Economy



Sources: International Monetary Fund and World Economic Outlook

THE DATAMATION 100

The U.S. market for information systems appears to be taking a back seat to other world regions, judging from research data. But chief information officers at U.S. corporations tell a different story.

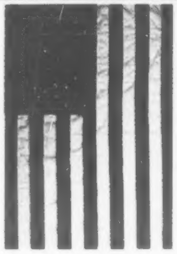
What's Right With the U.S. Market

A shortage of critical technology has slowed IT demand.

Although sluggish U.S. demand for information technology catches much of the blame for the computer industry's current woes, there is in fact an enormous need for certain types of IT that's largely going unmet. Standards-based computers, networks and software that would enable users to distribute processing across their enterprises are in short supply. The reason such demand isn't being met is immaturity. Suppliers and users of IT just haven't grown up enough to fully cooperate on developing products and services that will achieve enterprisewide objectives.

The need—identified by DATAMATION in scores of interviews with top IS executives in the United States—suggests a far different demand picture for IT than the one painted in

BY RALPH CARLYLE



economic forecasts or even in our own quantitative research findings. In this year's DATAMATION 100 analysis, for example, U.S. users come across as far less voracious in their appetite for technology than do their counterparts in Western Europe and the Far East.

These numbers and those churned out by economists, although useful in many other respects, belie the need expressed by users for distributed-computing components, such as networked workstations, that can be adapted easily to their businesses. "Everything is changing. And we need technology that reflects that fact," says Fran Dramis, chief information officer and a managing director at Salomon Brothers Inc. in New York City. The financial services firm is investing huge sums in computers that can be plugged in and pulled out at will as the firm's business changes. Much of Salomon's IT investment is going toward machines built with reduced instruction set computing (RISC) architectures and the UNIX operating system.

Worse yet, economic and research data—if used or interpreted improperly—can alter the behavior of U.S. users in a way that will come back to haunt them as they struggle to compete in global markets. Such data can turn users away from making the IT investments needed to drive revenues and productivity upward.

Here, then, is a view of IT demand as it really exists in the United States today. It's one that does not discard quantitative analysis, but rather seeks to represent it in the proper context. It's also one that examines new ways of measuring returns on IT investments—gauges that, if embraced by U.S. users, may drive revenues of DATAMATION 100 companies to new heights.

Economists agree that the U.S. economy this year will flirt with, but not enter, a recession (defined as two consecutive quarters of negative growth in the overall economy). They expect the country's gross national product (GNP) to grow at around 2% in 1990, down from 2.9% in 1989. Given this slower growth, and after factoring in interest rates, patterns in business equipment purchases and government spending, the U.S. Department of Commerce predicts that hardware shipments by U.S. suppliers will increase by only 4% this year to $73 billion. A separate agency study estimates that the U.S. market for software will grow around 18% to $27 billion in 1990.

Where the U.S. Economy Is Headed

There's also consensus that GNP growth will expand to 3% in 1991, when interest rates are expected to have eased a point or so to the 9% range. Such favorable economic factors, coupled with the beginning of a new product cycle for large-scale systems for IBM and its competitors, will drive IT demand by U.S. users back up, Commerce Department officials and others believe. Cahners Economics forecasts a 16% jump in U.S. computer and office equipment purchases next year, coming off a mild increase (6%) this year.

But do these economic indicators really show what is happening to IT? Only partly, in the eyes of many top information systems (IS) executives. "They are what you might call trailing edge indicators," says Robert J. Olsen, director of strategic information

North American Leaders

Companies in North America with the highest IS revenues

N. AMER. RANK	WORLD RANK	COMPANY	IS REVENUE ($ MILLIONS)	N. AMER. RANK	WORLD RANK	COMPANY	IS REVENUE ($ MILLIONS)
1	1	IBM	60,805.0	24	45	Andersen Consulting	1,225.7
2	2	Digital	12,936.7	25	47	Northern Telecom	1,150.0
3	5	Unisys	9,390.0	26	49	StorageTek	982.5
4	7	Hewlett-Packard	7,800.0	27	50	Microsoft	952.8
5	11	Apple	5,372.3	28	51	Commodore	866.5
6	12	NCR	5,319.0	29	52	Intergraph	860.1
7	16	Compaq	2,876.1	30	53	Motorola	860.0
8	17	AT&T	2,865.0	31	55	Intel	812.0
9	20	Xerox	2,790.0	32	56	Cray	784.7
10	21	Wang	2,697.0	33	57	Oracle	769.3
11	23	EDS	2,477.9	34	58	General Electric	740.0
12	26	Amdahl	2,101.0	35	60	Conner Peripherals	704.9
13	27	Sun	2,062.5	36	61	3M	696.4
14	31	Tandy	1,892.0	37	63	Black & Decker	687.6
15	34	Seagate	1,797.0	38	65	American Express	660.0
16	35	Control Data	1,691.0	39	66	Lockheed	590.0
17	36	ADP	1,689.5	40	67	Texas Instruments	585.0
18	37	Tandem	1,676.8	41	70	Lotus	556.0
19	38	TRW	1,643.0	42	71	SHL	539.8
20	39	Prime	1,520.0	43	73	Martin Marietta	502.2
21	41	CSC	1,442.8	44	74	NYNEX	495.0
22	43	Data General	1,296.5	45	76	AST Research	482.0
23	44	Computer Associates	1,290.1	46	77	Science Applications	479.0

systems at the University of Texas' MD Anderson Cancer Center in Houston. "They don't measure the leading edge, the things we are getting into or trying to get into, such as network computing." The popular single-digit indicators of IT growth are only a reflection, in Dramis' words, "of the hardware past the industry is dragging along, not the future it's trying to build."

Client/Server Systems Soar

Other observers insist that looking at IT demand as a whole is misleading. "You must always ask: "Which IT industry are we talking about?' " says Mark D. Stahlman, a securities analyst at Alex. Brown & Sons Inc. in Baltimore. "There are many, just as there are many types of IT budgets."

The economists are right in saying that mainframes, minicomputers and stand-alone PCs are mature, Stahlman believes.—that is, exhibit single-digit growth. "But networked workstations, client/server configurations and software are booming," Stahlman says. "They are the new world of demand that is emerging."

"Clients" are any intelligent desktop systems capable of running a robust application in concert with a server, whether it be a dedicated print- or file-server or a minicomputer or mainframe acting in such a capacity.

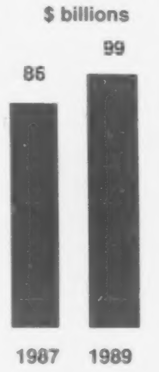
Workstation shipments by U.S. manufacturers should increase 40% in 1990 to $9 billion and nearly quadruple in value to $24 billion during the next five years, according to the Department of Commerce. Masking this explosive growth, of course, is the stodgy overall average for the industry.

For, while the overall economic indicators suggest a maturing industry and overcapacity, Stahlman and others are convinced that the major problem with the IT industry is actually undersupply. "Users have spent roughly $100 billion to $150 billion worldwide on PCs in retraining professional workers to perform tasks previously carried out by clerk-typists," Stahlman points out. "But that's not the type of productivity they are after." What corporate IT buyers in the United States want to do is leverage the productivity of some 40 million professional workers (including managers, sales and technical personnel). But the nature of the work they do, he explains, is an open-ended network of tasks and relationships that calls for much more sophisticated network-based technologies than are currently available in the commercial arena.

Such technologies have already surfaced in embryonic form in the technical and manufacturing arenas, where they are employed in the group-oriented processes of product design and the integration of design with manufacturing and distribution.

Competition Drives IT Investments

Such group-oriented "social computing"—so named because it is applied to a broad matrix of information-based social interactions—will become a major feature of the office landscape from 1993 onwards, in Stahlman's estimation, anchoring explosive growth in the IT industry. He expects annual sales of social-computing components to reach $50 billion by the end of the decade, building up to an installed base of systems worth $200 billion.



North America spent $99 billion on IS in 1989, up 15% from 1987.

N. AMER. RANK	WORLD RANK	COMPANY	IS REVENUE ($ MILLIONS)
47	78	Wyse	452.3
48	79	Dun & Bradstreet	450.0
49	80	Ernst & Young	450.0
50	81	Maxtor	447.2
51	82	Kodak	445.0
52	84	Novell	429.9
53	85	Mentor	426.4
54	87	3Com	413.9
55	88	Everex	402.0
56	90	MAI Basic Four	397.0
57	91	Quantum	394.2
58	92	Shared Medical	390.0
59	93	Dell	388.6
60	96	Tandon	377.9
61	98	Boeing	359.2
62	100	Concurrent	344.6
63	101	Silicon Graphics	343.0
64	102	Atari	342.0
65	103	Stratus	341.3
66	104	Dataproducts	328.0
67	108	Bell Atlantic	320.0
68	110	Micropolis	307.3
69	111	Gerber	306.1
70	112	Price Waterhouse	305.0
71	113	Datapoint	299.0
72	115	McDonnell Douglas	290.5
73	116	Tektronix	281.8
74	117	WordPerfect	281.0
75	119	National Data	275.7
76	120	Policy Management	265.6
77	121	Ashton-Tate	265.3
78	122	Bolt, Beranek & Newman	257.0
79	123	Recognition Equipment	248.6
80	125	Diebold	243.8
81	126	Genicom	238.7
82	127	Reynolds & Reynolds	236.1
83	128	Computer Task Group	233.0
84	129	Pansophic	232.0
85	130	American Management	225.3
86	132	Commerce	215.8
87	135	Digital Communications	213.5
88	136	Systematics	206.7
89	137	Ultimate	206.5
90	138	SAS Institute	205.6
91	139	HBO	203.6
92	140	General Datacom.	201.2
93	141	ASK Computer	186.0
94	142	Network Equipment	181.3
95	143	Sterling Software	180.2
96	144	Autodesk	178.6
97	146	Cincom Systems	171.1
98	147	Convex	158.6
99	148	Network Systems	144.8
100	149	Cadence	142.8

Big Exporters in North America

The North American companies with the most IS sales outside their home markets

	1989 RANK	COMPANY	IS REVENUES N. AMER.	EUROPE	ASIA	OTHER
1	1	IBM	26,146.2	21,281.8	9,120.8	4,256.4
2	2	DEC	5,950.9	4,915.9	1,940.5	129.4
3	5	Unisys	4,788.9	2,723.1	1,220.7	657.3
4	7	HP	3,744.0	2,886.0	780.0	390.0
5	12	NCR	2,234.0	1,702.1	1,063.8	319.1
6	11	Apple	3,438.3	1,235.6	644.7	53.7
7	16	Compaq	1,553.1	1,179.2	115.0	28.8
8	21	Wang	1,375.5	836.1	377.6	107.9
9	20	Xerox	1,506.6	892.8	83.7	306.9
10	27	Sun	1,093.1	515.6	453.8	0.0

Revenue figures are in millions of dollars.

Right now, U.S. users like American Express Co. and Salomon Brothers are at the leading (and, perhaps, bleeding) edge in pursuing their social-computing systems strategies. These often risky investments are being made at a time of slow growth in the economy and don't reflect the notion currently gaining popularity with economists that the economy and IT spending move in step, or "As with the economy so with IT." But, then, CIOs don't buy this notion, anyway.

"If there is a parallel in any year between what the economy is doing and what the IT business is doing, it's probably coincidental," says Phil Jordan, CIO and vice president of finance at Muzak L.P. in Seattle, the folks whose tunes are heard in elevators, dentists' offices and elsewhere. "Companies will invest in the face of a recession or to catch up with the competition or distance themselves from the competition. Every company has its own dynamics and its own special reasons for buying IT."

There are exceptions, of course—users whose IT investments definitely are a function of economic variables. The health care industry is one. "Hospitals often have to be reimbursed by the state for their services. And if the state is in an economic mess, they don't get reimbursed," says the University of Texas' Olsen.

Where competitive strategies do drive IT investments—the rule, in most cases—the risk for riding on the edge of technology doesn't just fall on the shoulders of IS executives. Sharing the burden—and, of course, the credit if IT investments pay off—are an increasing number of other individuals in the business units who also specify and buy IT products.

Fast Trackers in North America

The companies that grew the most in IS in 1989

	1989 RANK	COMPANY	1989 IS REVENUE	1988 IS REVENUE	% INCREASE
1	71	SHL*	539.8	195.0	176.9%
2	80	Ernst & Young*	450.0	178.0	152.8%
3	91	Quantum	394.2	172.5	128.5%
4	79	Dun & Bradstreet*	450.0	200.0	125.0%
5	57	Oracle	769.3	394.9	94.8%
6	93	Dell	388.6	257.8	50.7%
7	65	American Express*	660.0	446.9	47.7%
8	85	Mentor	426.4	300.8	41.8%
9	27	Sun	2,062.5	1,461.6	41.1%
10	84	Novell	429.9	306.8	40.1%

* Growth partly due to merger or major acquisition
Revenue figures are in millions of dollars.

Respondents on this year's DATAMATION budget survey guessed that an average of almost 34% of their IT purchases in 1989 had been made outside the IS organization, 42.5% in the public sector. Diane L. Lockwood, an associate professor of MIS at Seattle University refers to such spending as "off-line" and says it usually appears under decentralized departmental budgets and so is difficult to keep track of and often does not get included in estimates of IT spending.

"End-user spending has been growing . . . [probably] at the 15 or 20% growth level, but it's difficult to know for sure," says Raymond Wiltshire, vice president of computer-aided productivity at Martin Marietta Corp. in Bethesda, Md. "The only thing we know for sure is that business units are always spending more on IT than we think they are."

The result? Few user organizations in the United States have any idea what they are really spending on IT. Most are in the dark as to how these expenditures relate to their overall productive capacity or the economy as a whole. They just don't know whether technology is helping to write a better insurance policy, produce a more accurate debit/credit statement, bring a toy to market quickly or create a car worth driving.

Why Ignorance Isn't Bliss

This ignorance is a result of what one top European consultant calls a fragmentary view of IT, which is most pervasive in the United States. Paul Reynolds has worked with U.S. companies, but mostly provides advice on problem solving and decision making to the boards of such top European establishments as British Petroleum, Daimler-Benz and Royal Dutch Shell. He, and the company he heads, Wentworth Management Consultants Ltd. in London, also counsels governments. His European clients have taken the trouble to find out how IT relates to and could improve all of their economic activity, not just portions of it. "Shell, for example, now knows that 6.3% of all its economic activity is IT-related," Reynolds says. "Many American com-

Top Performers in North America

The companies with the highest returns on sales

	1989 RANK	COMPANY	1989 % RETURN ON SALES	1988 % RETURN ON SALES
1	50	Microsoft	22.1%	21.1%
2	57	Oracle	12.7%	18.5%
3	84	Novell	12.2%	11.3%
4	70	Lotus	12.2%	12.6%
5	36	ADP	11.6%	11.0%
6	16	Compaq	11.6%	12.4%
7	56	Cray	11.3%	20.7%
8	85	Mentor	10.7%	11.1%
9	91	Quantum	10.5%	(1.4)%
10	44	Computer Associates	10.3%	15.4%

panies would be hard pressed to come up with such a measure."

U.S. users have been content to measure IT's contribution to corporate performance in other ways. For example, IT spending is often expressed as a percentage of total sales: 2 to 5% of total sales is normal, depending on industry. Expressed as a percentage of total general expenses, IT accounts for some 4 to 10%, again depending on the industry. Then there's IT as a percentage of discretionary capital expenditures: here anything from 30 to 40% is today the norm.

"How much of this is really useful?" wonders Reynolds. "Isn't it better to have a measure of IT that relates to all spending and all a company's economic activity? . . . Surely, until we do this, we don't know what demand for IT really is. We don't know what we're talking about."

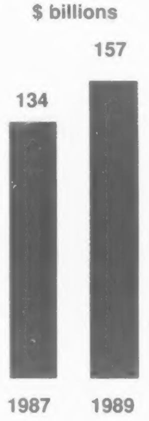
If U.S. companies do develop new, more embracing measures for IT, Reynolds predicts that industry growth will surge. "The IT budgets of these companies will climb as they become more aware of what their true needs are," he says. Some of his clients, he claims, have been increasing their budgets by as much as 35%. Much of this investment has gone toward the creation of an open systems technology infrastructure, which can adapt quickly to changing world conditions.

Aside from ignorance, Reynolds believes, the biggest drag on IT spending may be the IS budget itself, because funds within it are still viewed by many chief executives as overhead. "When Shell's Belgium subsidiary decided to get rid of all its internal IT resources, its budget was growing at around 15% a year. Since farming everything out, IT-related expenditures have increased 75%," he reveals.

Where Open Systems Suppliers Excel

A study of his European clients has also brought to light another interesting fact, says Reynolds. Only 15% of their total hardware/software budget for new applications is being spent on products and services offered by the world's top 20 suppliers. The rest is being spent on goods sold by an array of small, unsophisticated but very innovative companies.

Reynolds' message is also being echoed by a small, but growing number of U.S. users—notably in manufacturing and in the brokerage and accounting



North American IS sales have risen 17% since 1987.

Why IT Is a Factor of Production

Matching the demand of goods and services with the supply of them has become information technology's role in the 1990s, as global competition places a premium on efficiency.

In the good old days—when money was cheap, labor plentiful and markets undisturbed by foreign rivals—producers could get away with managing and coordinating the flow of their goods throughout the Western economy using only people and paper. Moreover, their customers were content to wait weeks for new orders to be filled—relying on massive inventories of products already shipped to them. But population growth is slowing, the number of skilled workers is diminishing and the cost of money is rising. Competitors are everywhere. And customers are impatient—they want everything yesterday.

"If you can't get cheap labor or cheap money, what's left?" asks Everett Ehrlich, vice president of finance and economic planning at Unisys Corp. in Blue Bell, Pa.

What's left, of course, is information technology—as Japanese corporations have so ably demonstrated. In the 1960s, when faced with labor shortages and rising wages, Japan's leading manufacturers invested heavily in IT, and in the process achieved wide gains in productivity.

What the Japanese and others have learned, says Ehrlich, is how to make information (and, by association, IT) a vital factor of production. "IT has become substitutable for labor and capital, or alternatively allows labor and capital to be more productive," the Unisys executive says.

Faced with overseas competition, high interest rates and a tight labor market, U.S. manufacturers have had to learn the same lesson. Since the current U.S. economic expansion began in late 1982, design and manufacturing processes integrated through IT have become the order of the day. The economy is beginning to reflect this shift. "The ratio of inventory to sales has gone down continually since 1982," says Cynthia Latta, senior financial economist at Data Resources Inc.

"Inventory behavior is now completely different in the U.S. [than it used to be]," says Raymond Wiltshire, chief information officer and vice president of computer-aided productivity at aerospace manufacturer Martin Marietta Corp. "There are no longer the inventory overhangs that are emblematic of the end of the business cycle. We're beginning to bust the business cycle."

sectors of the financial services industry. These users are investing in new networked-computing infrastructures—technology conduits that move critical data to all relevant decision makers at high speed and disseminate changes throughout the firm. The infrastructure includes everything from the workstation on a professional's desk to the network facilities and the collection of servers, hosts and database resources.

"Our infrastructure is like a puzzle to be put together as we conduct our business, and [it is] rearranged each day," says Salomon's Dramis. "Only the open systems vendors and the young, innovative companies seem to understand this."

Dramis and the others have discovered that what they are really demanding is technology that is "everywhere and nowhere," in the words of best-selling author Tom Peters, addressing executives at a recent forum of CIOs gathered together by the accounting firm Coopers & Lybrand. The industry is too immature yet to deliver it, and nobody, least of all the economists and IT budget makers, has yet found a way to measure it.

One shouldn't blame the economists. They agree with Reynolds that their assumptions are based on incomplete data, but they say the onus is on the corporations to express demand in new and more comprehensive ways.

"Only consumers tell the story of what IT demand truly is," says Madeline Franchi, a senior economist at Cahners Economics in Newton, Mass. "If they express it as overhead, or as a percentage of costs or capital, then that's all we have to go on."

In the Red

The companies that lost money

	1989 RANK	COMPANY	1989 EARNINGS LOSS ($ MIL.)
1	35	CDC	(680.4)
2	5	Unisys	(639.0)
3	21	Wang	(511.0)
4	39	Prime	(276.8)
5	43	Data General	(120.7)
6	99	Norsk Data	(60.4)
7	28	Memorex	(54.2)
8	8	Groupe Bull	(41.8)
9	90	MAI Basic Four	(40.0)
10	78	Wyse	(21.2)

Franchi and Cynthia Latta, senior financial economist at the Lexington, Mass.-based macroeconomics research house Data Resources Inc., say they are both comfortable talking about the economy as a whole, but not its impact on IT or vice-versa. "I simply don't know," says Latta, candidly. "It's easy to see why." ▭

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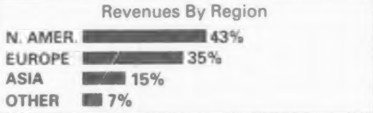
IS Revenues: $60.81 Billion

REGION		WORLD
1	IBM	1



INTERNATIONAL BUSINESS MACHINES CORP.

Old Orchard Road
Armonk, NY 10504
(914)-765-1900

Increased competition and a broad slowdown in the information technology industry challenged International Business Machines Corp. in 1989. The world's largest computer company responded with a strategy that involved cutting costs, focusing on global opportunities and pushing employees to respond better to users' needs.

The strategy may pay off this year or next, but it exacted a price last year. Profits at IBM plunged 35% to $3.8 billion in 1989—chiefly because of the company's decision to write off $2.3 billion against earnings in its fourth quarter to reflect restructuring and other charges.

Revenues worldwide for IBM did grow 5% to $62.7 billion in 1989. Sales in the United States increased for the first time in four years—a modest 2% to $25.7 billion. The company's strongest growth, however, continues to come from Asia, Europe, Central America and South America. Revenues from those regions now account for 59% of IBM's sales—up from 43% in 1985.

IBM CEO John Akers stresses cutting costs and customer needs.

IBM's European revenues grew 7.3% in calendar 1989, not quite as good as its 10.3% growth in the year before. However, in local currencies, the growth rate was really closer to 15%. To make sure its overseas revenues continue to grow, IBM has made some management changes, including giving general managers within countries global responsibility for serving key customers that operate multinationally.

Overall, IBM believes the industry should grow 8 to 10% in 1990. If it does, says IBM chief financial officer Frank Metz, the company should be able to boost its revenues this year in every product area and in every geographic area, including the United States. If IBM's performance in the first quarter of 1990 is any indication, Big Blue may indeed achieve its growth objectives. IBM's earnings climbed 9% to $1 billion on revenues that grew 11% to $14 billion in the first quarter of this year. Moreover, the company also achieved double-digit sales growth in the United States.

IBM is improving its fortunes in a variety of ways. For one thing, the company is trimming its employee ranks through attrition and early retirement. By the end of this year, the firm will have reduced its U.S. work force by 15% to some 200,000 workers. IBM also is ratcheting up efforts to provide answers to its customers' problems via a better-educated and -compensated sales force. And Big Blue is backing away from noncore businesses: last year the company completed the sale of its Rolm communications equipment development and manufacturing operation to Siemens AG.

In addition, IBM has broadened its market horizons, expanding into new businesses such as systems integration and facilities management. IBM also joined forces with independent software vendors like Atlanta-based Management Science America Inc. (now merged into Dun & Bradstreet Software), which agreed to develop products for IBM's OfficeVision integrated office automation suite of products. By the end of 1989, IBM had made equity investments in MSA and 74 other industry partners.

IBM's efforts to expand into new businesses produced mixed results in 1989. On the positive side, the company did manage to drum up some major new business from customers such as Eastman Kodak Co., which decided to turn much of its data center operations management and applications development over to Big Blue. On the negative side, IBM officials acknowledge that revenue growth from the company's software business has been slower than expected despite the solutions push. And profit margins on both software and services have been slipping.

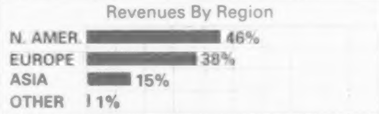
Software revenues at IBM were up only 6.3% in 1989, reflecting a continuing user trend toward data center consolidation. IBM last year saw its fastest revenue growth in personal systems and 3090 mainframe systems, although its overall processor business climbed only 7% for the year. Personal systems revenues streaked up by 19%, and the 3090 enjoyed double-digit sales growth and improved margins. IBM's revenues from peripherals and maintenance were down by 2.3% and 3.8%, respectively, in 1989.

New products such as the 3390 large disk drives and RISC System/6000 workstations figure to improve IBM's revenues in peripherals and workstations in 1990. The company's new cost structure (fewer employees) figures to raise profits, and its new business relationships should ensure software development for IBM systems. But IBM's ability—versus that of its competitors—to respond to user needs in the 1990s will be what really determines the company's financial figures in the future.

—*Jeff Moad*

IS Revenues: $12.94 Billion

REGION		WORLD
2	DIGITAL	2



DIGITAL EQUIPMENT CORP.

146 Main Street
Maynard, MA 01754
(508)-897-5111

How you judge Digital Equipment Corp. depends on where you sit.

If you're a neighbor and competitor of the company—seated at a desk at Data General Corp., Prime Computer Inc. or Wang Laboratories Inc.—things don't look all that bad at the world's No.2 computer maker. It didn't lose hundreds of millions of dollars in 1989. The company made money—$875.8 million to be exact. If you're on Wall Street, things look fat at the company—whose revenues per employee are half as much as those of competitors such as Apple Computer Inc.

If you're a customer or a potential one, the company does appear to have the product now, and in many sizes: high-end systems (VAX 9000); midrange systems (VAX 6000); transaction-processing systems (VAXft 3000); a host of low-end systems (VAX 5000, etc.); networking (Ethernet); proprietary (VMS) and open (ULTRIX) operating systems; tens of thousands of software applications; and a fair reputation for service and support. Digital also has a track record. The company last year shipped its 300,000th VAX system—some 12 years after the product family was introduced. In all, about 8 million people use VMS, Digital's proprietary operating system. And the company has size—with calendar 1989 revenues approaching $13 billion.

Sitting midway through 1990 and two weeks away from the close of Digital's fiscal year (June 30), how do things look? Well, hazy. Digital's quarterly earnings slumped 44% as it ended calendar 1989, and its chief, Kenneth Olsen, hinted that his company might actually lose money in the first three months of 1990. It came close, earning only $25 million on revenues of $3.3 billion. Digital's bottom line was reduced by a one-time restructuring charge of $150 million chiefly to cover workers' severance packages. Some analysts expect employee head count reductions on the order of 6,000 workers this year.

Digital's bread-and-butter business, minicomputers, is under competitive fire from workstations, high-performance PCs and versatile local area networks. And its single biggest market, the United States, remains somewhat sluggish.

Olsen appears anything but glum, however. The ideal response to an industry slowdown, says Digital's founder and president, is new products and new directions. And Digital has indeed responded. Branching out beyond the departmental, engineering and factory-floor applications that form its traditional base, Digital introduced so many products and services in 1989 that a list of them consumes 22 pages. And it is keeping up the pace in 1990.

The VAX 9000, Digital's entry into the mainframe market, leads the list of new high-performance products. Orders for the systems, which won't begin shipping in volume until the second half of this calendar year, exceed everyone's expectations. The VAX 9000's penetration outside Digital's traditional customer base, expected to be nonexistent, is proving significant. In a recent survey of DATAMATION subscribers, a full 45% of respondents who intend to buy a VAX 9000 this year or next say they are replacing existing IBM systems with the new DEC mainframe.

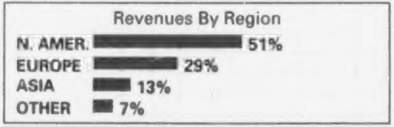
Securities analysts who follow the company are in search of another list, however. They want to know what steps Digital is going to take to reduce its costs. They believe Digital, with total employment of 125,900, is bloated and must inevitably go through the sort of painful reorganization that companies such as Data General and Wang have undergone, reducing their employee ranks by 10 to 25% in 1989.

"We're not doing too bad" is about as much as Olsen will say on the subject of his company's financial condition. Digital is sitting on nearly $2 billion in cash and liquid assets. It's putting more than 10% of revenues into research and engineering. And it's introducing new products practically every week. "Others may be hurting," Olsen says. "We're still generating revenue like crazy."

The question facing Digital is whether it can generate greater and greater amounts of revenue like crazy. Quarterly sales at the company hit their peak a year ago at $3.5 billion. Some analysts, however, expect the company to finish its fourth quarter with a bang—achieving $3.6 billion in revenues. *—Chris Sivula*

IS Revenues: $9.40 Billion

REGION		WORLD
3	**UNISYS**	5



UNISYS CORP.
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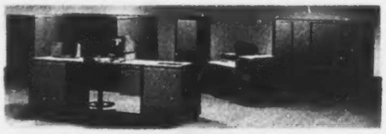
Michael Blumenthal would have liked to end his tenure as chairman and chief executive officer of Unisys Corp. on a high note. He wanted 1989 to highlight all of the strengths of the company he has guided since its formation in 1986. Instead, only the flaws were apparent: bulging inventories and a bloated cost structure that was way out of line with real market demand.



Unisys' mainframes currently account for 30% of total business.

By the third quarter, Unisys was involved in a painful restructuring of its whole operation: 8,000 jobs were cut and inventories slashed, eventually by as much as $700 million. Add to this a continued slump in the company's principal U.S. market (sales were off 4%); big losses in the defense business, which accounts for 25% of revenues; and a major (and expensive) product transition at the top of its mainframe families, and one can begin to see why Blumenthal described his swan song year as "painful," "disappointing" and "trying," each a classic understatement. All told, the company lost a whopping $639.3 million—almost the amount it had gained the year before—and its debt climbed $500 million to nearly $4 billion.

Highlights, if they can be called that, were a modest 2% increase in sales, which pushed Unisys through the $10 billion barrier ($10.1 billion), and an overall 9% increase in international sales, with especially strong showings from the European and Pacific Rim markets. In addition, the new 2200 series large mainframes are now in place and, although late, have been generally well received by customers (if generally ignored by the media because of the company's lowly 7% share of the mainframe business). Because mainframes (including processors, peripherals and software) currently account for 30% of total business, as opposed to the 15% contributed by open systems, the vote of confidence in the big machines was a welcome contrast to the general tone of the year.

Although it was an early leader in UNIX and other open system-based technologies, Unisys in 1989 seemed to be caught napping by the shifting pricing dynamics that such systems have brought to the industry. "The speed [of the shift] did surprise us somewhat," admits the new chairman and CEO, James A. Unruh. "And we realized as we got into the year that we were going to have to make much more substantial changes in our cost structure."

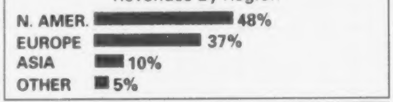
The company was also ill-prepared for sweeping changes in the government and defense sector of its business, particularly changes that Unruh calls "moving cost and risk to its contractors." Last year, the government began to shift research and development projects from cost-plus contracts to a fixed price basis. But Unisys was one of several companies that had large write-offs because of overruns on fixed price contracts. "Now, because of peace breaking out, budgets are under pressure and so are new programs," says Unruh, painting a bleak scenario.

By taking drastic measures in 1989, Unruh believes his company can compete effectively in selected U.S. market sectors such as financial services and retail, when they pick up. Although the company didn't make any money on its burgeoning open systems business or on PCs last year, Unruh says he hopes to in 1990. He also expects moderate single-digit growth for mainframes and for his whole business in 1990. *—Ralph Carlyle*

IS Revenues: $7.80 Billion

REGION 4 **HEWLETT-PACKARD** WORLD 7

Revenues By Region



HEWLETT-PACKARD CO.
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No mainstream information technology supplier has made the move toward distributed computing faster and more completely than Hewlett-Packard Co. The company is enjoying faster growth than most direct computer competitors, and it's encountering a new set of economics.

The benefits and the costs of changing from a U.S. supplier of proprietary minicomputer hosts to a global provider of standards-based desktop systems and peripherals are clearly evident in HP's 1989 financial performance. The company's information systems sales, DATAMATION estimates, grew 24% to $7.8 billion for calendar 1989, representing 65% of its $11.9 billion in corporate revenues. But earnings for the company failed to keep pace—climbing only 2% to $829 million.

The reason is fairly clear: there's less room for profit on sales of personal computers, workstations and peripherals—the source of more than 50% of HP's computer revenues—than on sales of minicomputers. HP's $500 million acquisition of workstation-maker Apollo Computer Inc. also hurt its 1988 bottom line.

HP will be going head-to-head with IBM in the 1990s. The two companies square off in personal computers (HP's Vectra line vs. IBM's PS/2 family); desktop laser printers (HP's LaserJet III vs. IBM's 4019 LaserPrinter); midrange/server systems (HP's 3000 line vs. IBM's AS/400 family); and workstations/servers (HP's 9000 and Apollo systems vs. IBM's RS/6000 series).

Many other companies are offering products based on operating systems like MS-DOS, OS/2 and UNIX. What makes HP any different? "Standards don't mean standardization," says Dean Morton, HP's chief operating officer. HP adds value atop standards, he says, pointing to the company's object-oriented New-Wave software.

The biggest indication of just how seriously HP takes distributed computing came earlier this year. In January, the company blitzed the industry with a 24-product rollout designed to reposition its minicomputers from hosts to servers. The company's RISC series—the HP 3000 family, running HP's proprietary MPE operating system, and the HP 9000, running the company's version of UNIX—now have nearly a dozen server models between them.

Adding customers—in key industry segments as well as geographically—may prove a daunting challenge. Manufacturing users currently account for more than 50% of HP's computer sales, and the company is looking to expand into other markets, such as financial services.

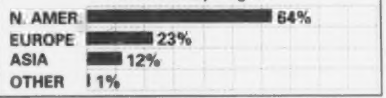
HP will face stiffer competition from the likes of NEC Corp. and Siemens AG as it strives to broaden its international sales beyond their current level—some 52% of HP's business overall. But demand for information systems is growing so fast in Europe and the Far East—30 to 40% a year by Morton's estimates—that HP has little choice but to attack globally.

As HP attacks new geographic, industrial and technological markets, it must discipline itself financially. Many of these new markets are best served through distribution channels other than direct sales—meaning that HP must accept narrower profit margins. Many require fast time to market and technologically sophisticated products—meaning that HP must continue to allocate nearly 11% of its revenues to research and development. Given these dynamics, it's likely that HP will continue to consolidate manufacturing activities and cap employee ranks at 95,000. *—Tim Mead*

IS Revenues: $5.37 Billion

REGION 5 **APPLE** WORLD 11

Revenues By Region



APPLE COMPUTER INC.
20525 Mariani Avenue
Cupertino, CA 95014
(408)-996-1010

By most yardsticks, Apple Computer Inc. performed exceedingly well during 1989. Despite an overall slowdown in the personal computer industry, Apple reported a 21% increase in net sales for its fiscal year and unveiled several new Macintosh models with impressive communications capabilities. The company also nurtured a strong financial position, represented by reserves of $809 million, a return on equity of 36% and no debt.

But the good news on revenues was offset by a disappointing 4.5% growth in earnings for calendar 1989, compared with a 50% leap in calendar 1988. In December, Apple's stock dipped following pessimistic earnings projections from several investment houses and reports that Apple's 9% penetration of the business market had stalled.

The resignation of Apple USA president Allan Z. Loren soon followed, along with the shutdown of one of three U.S. distribution/support centers as part of a cost-cutting program. A decision by the General Accounting Office to review a major Air Force contract that Apple received through Honeywell Inc. also didn't help.

Despite the company's troubles, international sales jumped 41% over the prior year to represent 36% of total net sales. The company also boosted research and development expenditures to $416.4 million, nearly 8% of sales. Such investment helped Apple blitz the industry with a series of new products, including the Macintosh Portable. "We really tried to focus heavily on the midrange of our product line," says Morris Taradalsky, Apple's vice president of customer service and information technology.

Increasing competition led many to question Apple's pricing and product mix strategies for both the business and home markets. For example, 1989's push to extend the Macintosh upward left an obvious vacuum at the low end of the market, where Apple reported disappointing Christmas sales for both the four-year-old Macintosh Plus and the aging Apple II family. Both systems had previously sold well into homes, schools and small businesses.

"Senior Apple executives did not agree as to the product and market directions in 1989," says Ash Jain, vice president of client services at Irvine Resource Group Inc., a research group in Irvine, Calif. "What was obvious in 1984 and 1985—that the market demanded an open Macintosh—was not at all obvious last year."

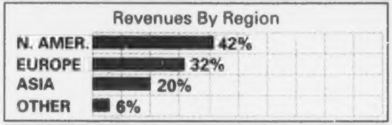
A clearer picture may begin to emerge in 1990, however, with chief executive officer John Sculley taking personal charge of Apple's new product activities. The appointment of Michael Spindler, formerly president of Apple Europe, to the position of chief operating officer, should also bode well for the company. With the architect of Apple's impressive European sales effort now heading up the worldwide marketing and manufacturing, Jain believes that Apple will regain a market-driven approach similar to what led to its 1985 turnaround.

While many Apple customers remain loyal, most see room for improvement in the pricing arena. "We would like to see a low-cost, modular, NuBus-based Mac in 1990," says Alan Soucy, manager of computing standards at Martin Marietta Information Systems Group in Chantilly, Va. For 1990, Soucy looks forward to the delivery of Apple's System 7.0 software, which will improve Macintosh performance without forcing customer migration to new hardware.

Apple has always shown remarkable resilience weathering the hard times. Considering the company's key assets—loyal users, an impressive software selection and considerable financial strength—cautious optimism seems warranted. Says Apple's Taradalsky: "One great thing about Apple is that it recognizes the importance of change. Unlike some companies, Apple can change very quickly." *—Paul Pinella*

IS Revenues: $5.32 Billion

REGION 6 **NCR** WORLD 12



NCR CORP.
1700 South Patterson Boulevard
Dayton, OH 45479
(513)-445-5000

In recent years, NCR Corp. has remade itself into a company known for its PCs and open systems. Shunted to the background was NCR's image as a stodgy purveyor of cash registers and bank-accounting machines. But in 1989 it was the NCR of old that kept this company on an even keel.

NCR's seasoned management can take much of the credit for keeping the company reasonably healthy in what was basically a down year. For calendar 1989, sales of NCR's information systems products (excluding business forms, semiconductors and micrographics) were essentially flat at $5.3 billion, and while earnings dropped 6% to $412 million, the decline owes a good deal to the $500 million NCR spent buying back its own stock.

Compared with Digital Equipment Corp., IBM and Unisys Corp., NCR sailed through 1989 with remarkable aplomb. The company concentrated on expense control, reducing its work force by 5% and cutting back inventory and working capital by some $200 million.

Like other IS vendors, NCR is suffering from the slowdown in financial services. "There isn't a lot of excess capital lying around," laments Mike Gibson, an NCR assistant vice president for branch automation in financial and office systems.

But NCR isn't taking it lying down. In what has been largely a replacement market for automated teller machines (ATMs), NCR has added enough bells and whistles to steal market share from industry leader Diebold Inc. And NCR also did well with its retail point-of-sale systems, signing up Burger King and Kentucky Fried Chicken for big orders.

Sales of these industry-specific workstations now account for a quarter of NCR's IS revenues—up from only 20% a few years ago—and provide a steady stream of business helping to offset flat sales in other IS lines and a 13% drop in NCR's once fast-growing PC business.

NCR shook up its PC unit and other divisions as part of a companywide reorganization that placed its 11 different product development units under two big umbrella groups: the Integrated Systems Group, focused on end-user products, and General Purpose Products, for value-added resellers and other third-party integrators. At the year's end, NCR introduced a 486 machine using the Micro Channel Architecture, which is being marketed through Businessland Inc.

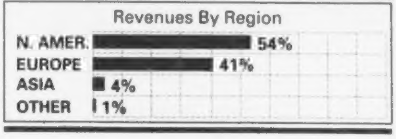
A new companywide emphasis on software should begin to affect the bottom line this year. Richard Barnard, vice president of data processing with The National Bank of Commerce in Charleston, W. Va., says that he is particularly impressed by the Universal Financial System, a new mainframe banking package that NCR introduced last year.

In February of 1990, NCR announced its commitment to developing software and hardware systems consistent with what it calls its Open, Cooperative Computing Architecture (OCCA). Based on a client-server model and using open interfaces based on industry standards, NCR's first OCCA product is Cooperation, a set of office automation software products incorporating Hewlett-Packard Co.'s NewWave technology.

Exley predicts that sales of software developed under OCCA will be a $200 million business for NCR in five years. The biggest impact is likely to be on third-party software suppliers, which until recently may have questioned NCR's open commitment. Now it seems clear: when it comes to open systems, NCR is going all the way. *—Joe Kelly*

IS Revenues: $2.88 Billion

REGION 7 **COMPAQ** WORLD 16



COMPAQ COMPUTER CORP.
20555 State Highway 249
Houston, TX 77070
(713)-370-0670

As Compaq Computer Corp. enters its ninth year, it's beginning to take on the patina of the brash, confident minicomputer vendors of the early

1970s. And no wonder. Last November, Compaq elbowed its way into minicomputer territory with the release of the SystemPro, an impressive dual processor network server built around Intel Corp.'s 80386 and 80486 chips. Revenues grew in calendar 1989 by nearly 40% to $2.9 billion, while net income increased 31% from $255.2 million to $333.3 million.

The SystemPro is the most technically complex machine Compaq has ever offered. To pull it off, Compaq worked closely with a number of third-party hardware and software suppliers, including Emerald Systems Corp., a storage products company based in San Diego, and Microsoft Corp., which supplied a special version of its LAN Manager network software to take advantage of the SystemPro's special design.

The SystemPro wasn't Compaq's only 1989 hit. The company also introduced the LTE laptop computer in October, a model that became so popular demand outpaced production well into this year. Although Compaq declined Japanese assistance for previous computer generations, for the LTE it called upon Citizen Watch Co. to provide laptop screen expertise and help in solving some manufacturing problems.

Compaq demonstrated its clout last year when it severed its relationship with one of its major dealers, Businessland Inc. of San Jose. In February of 1989, the company charged Businessland with demanding special treatment over other dealers and with favoring IBM's Micro Channel Architecture machines over Compaq's Extended Industry Standard Architecture (EISA) PCs. In March of this year, the two mended fences. The yearlong rift probably hurt both parties to some extent, but Businessland appears to have suffered most of the damage, reporting lower earnings this year than last.

Businessland-style resellers are just what Compaq needs if it is to continue to outpace the industry's growth rate without incurring the high overhead that mainframe and minicomputer companies have, says Michael Swavely, president of North American operations. "Why should I emulate them, when [overhead is] exactly what they're trying to cut right now?" he asks. Instead, Compaq plans to support its dealer channel and gradually add direct support capabilities for its higher end systems. To that end, says Swavely, Compaq doubled its U.S. training and support budget in 1989.

In March of this year, Compaq opened demonstration centers at four regional offices around the United States, primarily to demonstrate the abilities of the SystemPro. Still, sales will continue to go through the dealer channel.

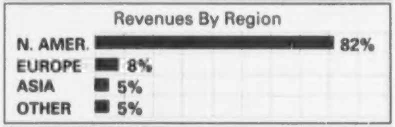
Meanwhile, Compaq has stepped up its investments in strategic supplier companies, a move similar to its 1988 infusion of $100 million into disk drive maker Conner Peripherals Inc. of San Jose. In early 1990, Compaq took a stake in NexGen Microsystems, a San Jose startup that is developing a high-end chip set offering functionality similar to Intel Corp.'s 80486 microprocessor. The stake in NexGen, said to be between $5 million and $10 million, is seen as an effort to reduce Compaq's dependence on Intel's chips.

Also this year, Compaq announced a technological agreement with Novell Inc. to work on creating a mirrored server to move its server class of machines into the fault tolerance market. That type of research and development will continue, Swavely says.

The SystemPro, however, represents the first taste of what Compaq sees as the computer company of the 1990s, not bound by appellations such as mainframe, minicomputer, workstation or PC. Says Swavely: "I think what you'll see through the 1990s is a total blurring of traditional boundaries." *—Bob Francis*

IS Revenues: $2.87 Billion

REGION		WORLD
8	AT&T	17



AMERICAN TELEPHONE & TELEGRAPH CO.
550 Madison Avenue
New York, NY 10022
(212)-605-5500

After six post-divestiture years of slamming into what at times appeared to be an impenetrable wall in the computer business, AT&T's Data Systems Group began to break through in 1989.

Last year, the Data Systems Group was estimated to have lost about $150 million selling PCs, minicomputers, terminals, software and other data products. But that loss is much less than the $300 million shortfall that had been estimated for 1988. DATAMATION reckons AT&T's total 1989 IS business—including not only the Data Systems Group but also PBXs, modems and other datacom products—at about $2.9 billion, up from $2.4 billion in 1988.

AT&T itself posted $36.1 billion in revenues, up from $35.2 billion, with net income at $2.7 billion, compared with a loss of $1.7 billion in 1988.

The Data Systems Group, which was reorganized last year to include AT&T Computer Systems, UNIX Software Operations and Synchronous Terminal Products, scored big contract wins with American Airlines Inc. and the Federal Aviation Administration and began working on a huge U.S. Air Force contract it won late in 1988.

In June, the company was awarded a $100 million 386-based workstation, server and local area network contract by AA to upgrade the SABRE reservation system. The FAA award, under what is called the Office Automation Technology and Services (OATS) contract, is valued at $853 million over three years. This contract calls for automating certain functions in Department of Transportation offices. Meanwhile, after resolution of a contract protest, AT&T tackled the $929 million Air Force Standard Mulituser Small Computer Requirements contract it won in October 1988. This three-year contract calls for the delivery of 3B minicomputers, networks and systems integration services to the military. In 1989, AT&T also won a $25 million contract from Firestone for PCs, printers and LANs and a $7 million contract from the New York State Department of Health for PCs, printers, 3Bs and modems.

The group was also active on the technology and alliance fronts. In June, AT&T announced that it had sold its stake in Ivrea, Italy-based Ing. C. Olivetti & Co. SpA, its long-time PC supplier, and that Olivetti would no longer be its prime PC vendor. In July, it was announced that AT&T and Intel Corp. would jointly develop PCs, and in January of this year the company said it would also build its own, Intel-based PCs in Little Rock, Ark. From the company's UNIX operation in November came version 4.0, which represented a merger of the Berkeley, XENIX and System V UNIX variants. The 3B2/1000 minicomputer was introduced last year, as well.

In October, AT&T signed an agreement with Pyramid Technology Corp. to jointly develop a line of UNIX-based high-performance computers. AT&T will market the machines, which were formally announced in April, on an original equipment manufacturer (OEM) basis as the System 7000. The company also strengthened its relationship with Sun Microsystems Inc., which has consisted of UNIX development work as well as an equity investment in Sun via joint systems integration work.

Gordon Bridge, president of the Data Systems Group's Computer Systems unit, says 1989 was a year in which the company's strategy to be a "leader in networked computing solutions" began to pay off. And he says he's very optimistic about 1990. "We have lots of challenges and competition," says Bridge. "[Still,] we're experiencing a substantial growth in business. We're not ordering champagne yet; we're keeping our heads down. It will be nice to put the issue of profitability behind us."

—David R. Brousell

IS Revenues: $2.79 Billion

REGION		WORLD
9	**XEROX**	**20**

Revenues By Region

N. AMER.	54%
EUROPE	32%
ASIA	3%
OTHER	11%

XEROX CORP.
P.O. Box 1600
Stamford, CT 06904
(203)-968-3000

"People respect IBM," observes Bud Caldwell, a Xerox Corp. vice president, "but they like Xerox."

Caldwell should know. He is vice president and general manager of Xerox's Custom Systems Division, its systems integration arm. And he's one of a slew of ex-IBMers now prominent at Xerox, including William C. Lowe, executive vice president in charge of Xerox's Development and Manufacturing Division, and Dennis W. Andrews, vice president of Xerox's systems software unit.

The ex-Big Blue team's mission is to build on Xerox's strength in printers and copiers to make it a presence in corporate publishing and document management. The playbook includes open systems and systems integration.

In the information systems field, Xerox hasn't been able to duplicate its success with copiers. DATAMATION estimates that only 16% of Xerox's $17.6 billion in corporate revenues in calendar 1989 came from sales of printers, workstations and other products and services related to information systems. One reason IS accounts for so little is that Xerox's efforts to design, make and market PCs and workstations have fared poorly. That's why the company decided to migrate its systems to UNIX and the Sun Microsystems Inc. SPARC microprocessor as part of an overall strategy to embrace open systems.

Xerox's IS-related revenues grew only 5% to $2.8 billion last year while its entire document-processing business (including IS) expanded 6% to $12.4 billion. Income from document processing jumped 24% to $488 million. Last year's earnings in Xerox's other main business, financial services, actually declined 9% to $216 million despite a 9% increase in revenues to $5.2 billion. Hurricane Hugo, the San Francisco earthquake and the downturn in the securities business hurt Xerox's insurance and investment-banking profits.

Xerox's most successful effort in IS is supplying printers for mainframe installation and corporate publishing environments, with its 9700 printer line serving as the mainstay. In 1989, the company introduced the Xerox 4650, a $150,000 printer that prints 50 pages per minute with a resolution of 600 dots per inch. And on the low end, it unveiled the 4030, a $3,000 desktop printer. "Through our printers, publishing systems and smart copiers, we can be partners with a lot of other people," Lowe says.

Most of Xerox's partnerships in 1989 were in systems integration. It snared a $4 million contract to lead one of four teams submitting design proposals for the Army's Computer-Aided Acquisition and Logistics Support (CALS) System—a massive effort to set standards governing the way the Army manages and communicates complex documents to contractors and other government agencies. CALS will ultimately be installed at 56 Army sites and will cost some $500 million.

On the legal front, Xerox met defeat in its attempt to get credit for developing the graphical user interface that Apple Computer Inc. uses on its Macintosh desktop system. Although Apple concedes it made use of Xerox's design, in March a federal judge threw out most of Xerox's copyright suit. Xerox is appealing the decision.

—Joe Kelly

IS Revenues: $2.70 Billion

REGION		WORLD
10	**WANG**	**21**

Revenues By Region

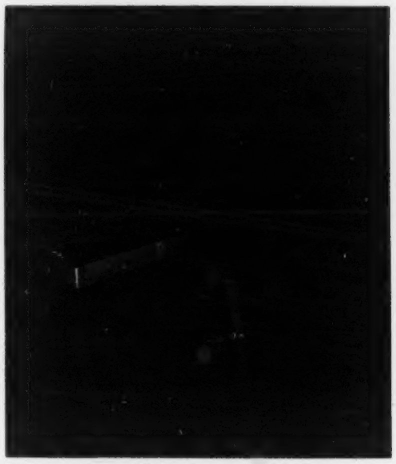
N. AMER.	51%
EUROPE	31%
ASIA	14%
OTHER	4%

WANG LABORATORIES INC.
1 Industrial Avenue
Lowell, MA 01851
(508)-459-5000

Change is the order of the day for Wang Laboratories Inc. The company is developing standards-based computer systems to complement its proprietary line of products. It's adjusting to a new management team that emphasizes efficiency over legacy. And it's betting big on imaging to improve its sagging fortunes.

Wang's new emphasis on standards is a major shift. Prior to the company's formal announcement of an open systems strategy last December, Wang had clung to its proprietary VS computer family even as many of its competitors bolted to UNIX, the AT&T operating system that's practically become synonymous with open or standards-based systems. That persistence led Wang to an 8% drop in sales in calendar 1989 to $2.7 billion and a $500 million loss, as customers held off buying proprietary systems from second-tier suppliers that had no formal open systems direction.

Things only got worse for Wang in 1989, a year that saw the company foun-



Wang's future is in the capable hands of Richard Miller.

der's son resign as president and chief operating officer. To start with, stiff price competition and a shift to the networked PCs and workstations cut Wang's margins in 1989. Additionally, service and rental income declined for the first time in 1989. Finally, foreign markets, the sole source of growth in product sales over the past three years, were hit hard by a strengthening dollar last year.

By the time Wang's fiscal year had ended in June 1989, the company had racked up $424 million in losses on $2.9 billion in revenues. Wang's credit rating dropped so low that it couldn't float short-term loans needed to meet operating expenses. After defaulting on some of its long-term loans, Wang finally reached new credit agreements with lenders—but only by pledging all assets, except inventory, as collateral. In the midst of this turmoil, Frederick A. Wang resigned as president and COO. His father and founder of the company, An Wang, remained as chairman and chief executive officer until his death a few months ago.

The man in charge of Wang these days is Richard W. Miller. After taking over for Fred Wang at the end of August, Miller spent two months reviewing the company and talking to customers. He next announced a reorganization plan for Wang intended to flatten the organization, speed delivery of products, minimize hassles for customers in dealing with Wang and rid the company of unnecessary assets and perks. He assumed the elder Wang's job responsibilities in March 1990.

Miller's track record may make him suited for the job. When RCA Corp. was acquired by General Electric Co. in 1986, he was called in to head up its consumer electronics division. There he presided over a restructuring that is credited with turning the company around.

Miller already seems to be making progress at Wang. He's chopped the work force by nearly a quarter to 22,500 employees. He's reduced operating costs by $300 million a year. He's sold off enough assets to trim $300 million off the $575 million Wang owes creditors. By selling additional assets, Wang hopes to pay off the entire debt this year.

By the end of the calendar 1989, Wang's financial condition looked in much better shape. Losses for the second half of the year totaled only $72.6 million—a noticeable improvement from the first half, when the company's bottom line dipped deeper than $400 million into the red. Sales still were suffering, however. Wang's calendar 1989 IS revenues were $2.7 billion—down from $2.9 billion the year before.

Despite problems elsewhere, 1989 sales of the Wang Integrated Image Systems (WIIS) grew by 25%. Four image-intensive markets—financial services, government, manufacturing, and legal and professional services—account for 75% of Wang's customer base.

Wang has entered agreements with several software companies to integrate industry-standard products with its imaging technology. It has cut deals with Oracle Corp. for its relational database software; Gupta Technologies Inc. for its PC application development tools; and Novell Inc. for jointly developing an image server for NetWare users.

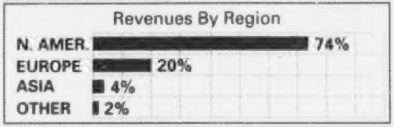
Wang is banking on image technology to open doors into the open systems realm for the company, with plans to develop future image applications on UNIX platforms. Wang admittedly is late to the open systems market, only announcing a strategy for entering it seven months ago. OPEN/Architecture, as Wang calls its UNIX-based suite of products and services, follows an industry trend toward a client/server model for distributed, heterogeneous environments based on standards.

—Chris Sivula

IS Revenues: $2.48 Billion

REGION		WORLD
11	EDS	23

Revenues By Region



ELECTRONIC DATA SYSTEMS CORP.

7171 Forest Lane
Dallas, Texas 75230
(214)-661-6000

Now that most of its key systems manufacturing partners have decided to become its competitors too, Electronic Data Systems Corp. must look to new strategies and tactics in order to sustain the kind of growth its shareholders have come to expect.

Although 1989 saw IBM, Digital Equipment Corp. and most of the Big Eight accounting firms getting into the systems integration and facilities management business that EDS pioneered 28 years ago, the General Motors Corp. subsidiary still managed to post record sales and earnings. EDS reported revenues of $2.46 billion from non-GM sources, up 23.5% compared with 1988's showing. EDS' total revenues, including business with GM, was $5.47 billion, up 13%. The company's revenues from non-GM sources rose from 41% of total revenues in 1988 to 45% in 1989. EDS' earnings increased 13% to $435.3 million.

"People ask me from time to time, 'How long can you keep it up?' " says EDS senior vice president Gary Fernandes. "The answer is: I don't know. I hope for a long time in the future."

To make sure that happens, EDS is trying to boost its image both domestically and internationally; to expand its presence in key manufacturing, transportation and energy markets; and to lower the price it pays for raw materials—i.e, information technology.

Early in 1989, to lower its raw materials costs, EDS finalized an agreement to acquire a minority interest in Hitachi Data Systems Corp., formerly the National Advanced Systems Corp. plug-compatible manufacturer subsidiary of National Semiconductor Corp. EDS became a partner in HDS, says Fernandes, because increasingly its competitors in the systems integration business are hardware manufacturers. "Traditionally, we thought we could get our [hardware] costs down through volume, but that's not true when you're competing with manufacturers," he says.

EDS made another major financial move later in the year when it bought a stake in System One—Texas Air Corp.'s computer reservation system. In exchange for its investment, EDS got a 50% equity interest in the reservation system plus a facilities management contract valued at as much as $4 billion. And EDS overnight gained a major position in a key transportation market.

EDS also made moves into other significant, relatively untapped markets for the company. In manufacturing, EDS beat out IBM for a 10-year contract to manage and operate data centers and voice and data communications for Cummins Engine Co. Inc. of Columbus, Ind. And in the energy market last year, EDS followed a 10-year management agreement with New Orleans-based Freeport-McMoRan Inc., as well as a similar deal with Enron Corp. in Houston. "We're pleased with the continued penetration in these areas," says Fernandes.

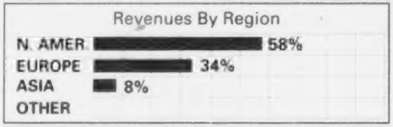
EDS also is making organizational changes designed to improve its position as a global service provider and drive decision making closer to its customers. The company, which currently derives only about 15% of its revenue from outside the United States, reworked its international reporting structure, giving managers outside the country more functional support and the freedom to make more decisions.

The entry of competitors such as IBM into the systems integration and facilities management business has forced EDS to face some new challenges. But, says Fernandes, it has also brought new attention to EDS' business. "It has created a lively public debate about such issues as outsourcing and an awareness that we could never have done on our own."

—Jeff Moad

IS Revenues: $2.10 Billion

REGION		WORLD
12	AMDAHL	26



AMDAHL CORP.
1250 East Arques Avenue
Sunnyvale, CA 94088
(408)-746-6000

Among systems suppliers, Amdahl Corp. has stood out as a success in recent years—despite occupying a market many dismiss as bygone: mainframe computers. Sales at the company, whose large scale systems are compatible with those made by IBM, have more than doubled since 1986.

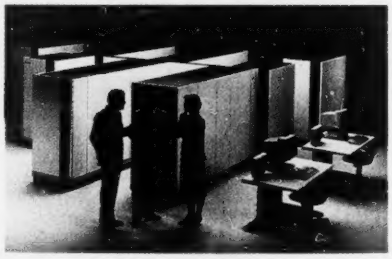
What kept Amdahl's star shining in 1989 was its ability to keep pace technologically with competitive moves and customer needs. The company's 5990 mainframes, new storage systems and rapid implementation of IBM's Enterprise Systems Architecture (ESA)—an enhanced version of Big Blue's chief large scale operating system—sent Amdahl into the $2 billion revenue galaxy last year.

Keeping up or ahead of IBM—Amdahl's chief rival—has its rewards and its price. In 1989, the price/performance features of Amdahl's products were so alluring that nearly one out of every four systems Amdahl shipped went to new customers, raising company sales nearly 17% to $2.1 billion. IBM reacted by discounting its systems, which forced Amdahl to cut profits. Earnings at the company fell 30% to $153 billion last year.

Although discounting may ease in 1990, earnings still will be under pressure from the high prices Amdahl pays in U.S. dollars to buy computers and components from Fujitsu Ltd. The Japanese company not only owns part of Amdahl, it supplies the U.S. concern with much of the technology that goes into the 5990s (which now account for the majority of Amdahl's sales) and two other new products: the 6100 storage subsystems and the new 7300 UNIX computers. Purchases of computers and subsystems from the Japanese company totaled $767 million in 1989.

Two other factors that hurt earnings at Amdahl in 1989 actually signify good things for its customers. The company increased R&D spending by 25% to $277 million. And it set aside well over $100 million in engineering charges to convert existing Amdahl customers to ESA. "I'm counting on ESA being available and not just on the machines that are running at Sunnyvale," says Clark Johnson, director of information services for the city of Indianapolis, an Amdahl shop. Johnson intends to upgrade the city's Amdahl machines to ESA in 1991 or 1992. All new 5990s and 5880s ship with ESA.

Amdahl is making progress elsewhere—technologically and geographically. In early 1989, the company released an updated version of UTS, its version of AT&T's UNIX System 5 operating system. Most of Amdahl's UNIX sales are on systems that are also running MVS, IBM's chief large scale operating system. Amdahl's first computers dedicated exclusively to the UNIX marketplace are its 7300s, which are reprogrammed versions of Fujitsu M 760-class mini-mainframes. The company also paid $30 million to buy Key Computer Laboratories Inc., a Silicon Valley start-up developing high-performance UNIX-based machines.

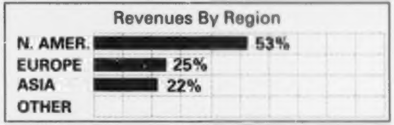

The price/performance of the 5990 helped raise Amdahl's sales nearly 17%.

Two big orders from the Australian government boosted Amdahl's Asia/Pacific revenues to more than 8% of sales in 1989. In Europe, which accounts for more than a third of the company's sales, Amdahl appointed Peter V. Williams, who was general manager of European sales, to a new post as office of the chairman-Europe.

—Joe Kelley

IS Revenues: $2.06 Billion

REGION		WORLD
13	SUN MICROSYSTEMS	27



SUN MICROSYSTEMS INC.
2550 Garcia Avenue
Moutain View, CA 94043
(415)-960-1300

In 1989, Sun Microsystems Inc. displayed a characteristic that could make the workstation maker a far more powerful force in the 1990s than some might have predicted a year ago. No, it wasn't that Sun hit $2 billion in information systems sales in 1989, although such a revenue record for an eight-year-old company is impressive. And no, it wasn't that Sun set a new price/performance standard in client-server computing with its SPARC family of computers, although 12.5 million instructions per second of computing power priced at $8,995 was mind-boggling for a time.

What distinguished Sun was its ability to manage through adversity—a quality that may again be tested as competition heats up in the company's chief line of business, UNIX workstations.

The real mettle of CEO Scott McNealy & Co. was tested last summer. What was supposed to have been a glorious conclusion to Sun's 1989 fiscal year, which ended June 30 of that year, turned out to be a disastrous quarter in which it lost $20.3 million. Everything seemed to conspire against Sun in its attempts to undertake the most important product transition in the company's short life to its own scalable processor architecture. Components were in short supply. Two top ex-

Scott McNealy with Sun's star performer, the SPARC workstation.

ecutives resigned. And Sun's internal information system management just didn't work up to par.

Suddenly, Wall Street analysts began to note just how much cash Sun's heady growth was burning up—as much as $30 million a month at one point, by McNealy's own reckoning. Overnight, the price/performance leader in distributed computing became just another troubled high-technology company.

"We hiccuped in 1989, but we're well beyond that now," says Ed Zander, vice president of corporate marketing for Sun, of the company's difficulties. Just how far beyond is remarkable, although the company remains cash strapped. Sun rebounded to profitability in the very next quarter. For all of calendar 1989, Sun earned $36.1 million on $2.1 billion in IS sales—down 60% in net income but up 40% in revenue from the previous year.

Virtually all of Sun's sales growth in 1989 came from a new line of workstations and servers introduced in April 1989 and based on its SPARC architecture. Systems based on the reduced instruction set computer (RISC) implementation now represent 80% of Sun's current sales—giving the company far greater control of its technical destiny than it had in the days when it relied on Motorola Inc. to supply 80% of the horsepower for its systems. Such control may well be needed by Sun in the days ahead as it battles against Digital Equipment Corp., Hewlett-Packard Co. and IBM.

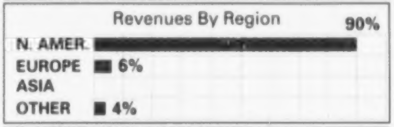
"Competitive announcements of workstations just reinforce our strategies," Zander says of new competitive offerings such as IBM's RS/6000 family of workstations and servers. "They create a much larger market for us to sell into."

But why should IS executives buy UNIX workstations from Sun when they can shop at $63 billion IBM or $13 billion Digital or $12 billion HP? Zander offers three reasons. One, Sun has scale. It's a $2 billion company with 12,000 employees, dwarfing the size of Digital's or HP's workstation operations. Two, Sun has software. More than 2,000 applications have been written for the SPARC platform, alone. Three, Sun singularly focuses on distributed, client-server computing.

Sun also has some limitations. Despite its effort to better manage costs, the company is still using more cash than it generates. The company had to secure at least $240 million in new debt financing to see it through fiscal 1990. Despite its effort to expand beyond technical computer sales, Sun still derives most of its revenues from software-engineering and design automation applications. Despite its orientation toward standards-based computing, Sun still must spend heavily on research and development—13% of revenues a year—to keep ahead of the competition. *—Tim Mead*

IS Revenues: $1.89 Billion

REGION		WORLD
14	TANDY	31



TANDY CORP.
1800 One Tandy Center
Fort Worth, TX 76102
(817)-390-3700

After the many new strategies, partnerships and research projects that Tandy Corp. initiated in 1988, it is only natural that 1989 should appear rather calm in comparison. Corporate revenues for the diversified electronics company last year grew only 7% to $4.3 billion, with nearly 45% of Tandy's sales coming from desktop systems and peripherals.

The company's earnings declined to $304 million in 1989, a 6% drop from the $323 million net income in 1988. The performance reflects, in part, declining profit margins in the personal computer business. The settlement of a patent dispute and cutthroat competition in consumer electronics, Tandy's main business, also hurt the bottom line.

However, this year's profits may benefit from marketing and technology initiatives that Tandy has taken in the past two years to reposition itself in the PC business. In 1988, the company purchased Fremont, Calif.-based Grid Systems Corp., a laptop and portable PC manufacturer that now is making impressive large-account sales. One sale in 1989 was a 400-unit order to supply laptop systems to American Airlines Inc.

An alliance with Digital Equipment Corp. to resell Tandy PCs under the Digital name provides Tandy with an additional channel for reaching *Fortune* 1,000 customers. And Tandy's DeskMate, a Windows-like graphical user interface for entry-level PCs, received the endorsement of Lotus Development Corp., which ported its popular 1-2-3 spreadsheet program to run on DeskMate-equipped systems.

Tandy's purchase of Grid Systems, and the subsequent reshuffling of responsibility of large corporate accounts to Grid, will have the most impact on the *Fortune* 1,000 market. The Tandy-Grid merger has produced a dependable supplier of high-quality computers in the eyes of James Montequnin, manager of communications for Union Pacific Railroad in Omaha. Originally chosen as a second source for PCs (after IBM), Tandy—via Grid—has emerged as Union Pacific's chief laptop supplier. "I probably wouldn't have looked at Grid for my laptops without them being associated with Tandy. But with Tandy behind them, you know they're going to be around, and you know they'll be offering price-competitive products," Montequnin says.

One reason Tandy can compete on price is its manufacturing prowess. The company is regarded as having perhaps the lowest production costs of any U.S. PC manufacturer. Tandy's $11 million Fort Worth plant, which opened in April of 1989, is capable of producing 5,000 computers a day and has labor costs amounting to less than 2% of the cost of each computer.

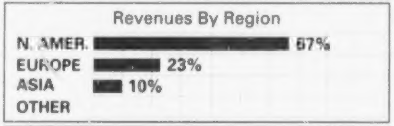
However, Tandy needs to improve in the marketing area. After years of trying, Tandy still has not really cracked the *Fortune* 1,000 market. The company's share of such business is so low that it gets lumped with "other" in market analyses. Large accounts offer significant growth opportunity for Tandy, which must tap into that potential to remain competitive with Apple Computer Inc., Compaq Computer Corp. and other PC makers effectively serving the biggest U.S. companies. To Tandy's credit, it can compete for large accounts when it chooses to—as it did in winning part of a 50,000-unit PC order from American Airlines (separate from the Grid contract).

Sales of systems at the low end of the U.S. PC market, which Tandy reaches via its Radio Shack outlets, have slowed, leading the company to place more emphasis on high-end products and foreign sales. Tandy last year acquired Victor Electronics—a Swedish supplier of desktop, laptop and handheld computers to European business users. Victor complements the company's consumer PC marketing efforts in Europe, where Tandy sells systems through the electronics stores of Fort Worth-based InterTAN Inc.

Looking toward Japan, Tandy continues to maintain close ties to Matsushita Electric Industrial Co. Ltd., better known in the United States for its Panasonic, Quasar and Technics consumer products. Tandy makes PCs for Matsushita. *—Bob Francis*

IS Revenues: $1.80 Billion

REGION **15** **SEAGATE** WORLD **34**



SEAGATE TECHNOLOGY INC.
920 Disc Drive
Scotts Valley, CA 95066
(408)-438-6550

Alan Shugart, the burly 58-year-old founder and chief executive officer of Seagate Technology Inc., can't be called a timid person. After a disastrous 1988, when a market miscalculation lead to a $5.5 million calendar year loss by Seagate (caused by a whopping single-quarter loss of $52.8 million), you'd have expected the company to think about retrenching in 1989. Instead, it laid out $300 million in cash and notes and nearly 11 million of its own shares to buy Control Data Corp.'s Imprimis disk drive business.

After the acquisition was completed in October, Seagate added Imprimis' financial results to its own. It reported fourth-quarter revenues of $690 million, double those of the same period in the year before. It ended calendar year 1989 with a profit of $104.7 million on sales of $1.8 billion. The acquisition doubles Seagate's size to a $2.5 billion organization (if you count a full year's worth of Imprimis sales), with a hefty research budget of $130 million.

Buying Imprimis provides Seagate with access to new markets—technologically and geographically—and new sales channels. It gives the company an entry to the high end (1 to 2 gigabytes) of the disk drive market—one in which none of Seagate's existing products competes. (Seagate itself makes rigid disk drives for use in small computers.) The Imprimis addition breaks new ground in Europe, the Pacific Rim and the United States. All but one of the Imprimis manufacturing facilities are in locations where Seagate isn't present—in Minnesota, Nebraska, Oklahoma, Malaysia, Portugal, Singapore and West Germany. Imprimis had recently built a new plant in Singapore, where Seagate operates a manufacturing facility. Seagate had sold its products mainly through distributors; it can now join forces with an Imprimis domestic and international sales organization that has very strong original equipment manufacturer (OEM) relationships.

It is only now that Seagate is beginning to retrench, seeking to strip away fat from Imprimis' budgets, dismantle structures and seek efficiencies in common sources of supply. For example, the thin-film manufacturing activities of each company are being combined.

In Shugart's mind, the acquisition enhances the company's scope of products, extends its reach virtually worldwide. Early this year, Seagate launched an advertising campaign that emphasized its capability to deliver drives for "the lightest laptop to the mightiest mainframe."

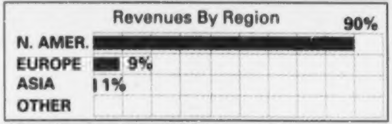
Shugart doesn't envisage any new storage technologies on the immediate horizon that could have an impact on magnetic medium. " 'I see lots of opportunities in large scale wafer integration in semiconductors when that technology is perfected. But it won't be in my lifetime."

Recently the U.S. Commerce Department said it would begin to allow the sale in Eastern Europe of disk storage devices with capacities up to 40 megabytes. Seagate, whose 17 overseas sales and support offices are in such strategic locations as Austria, Britain, France and West Germany, isn't hesitating. Seeing a "very large potential market," in Eastern Bloc nations, Shugart recently began running ads in Soviet computer trade papers. "We want to be there early," he says.

—Tom McCusker

IS Revenues: $1.69 Billion

REGION **16** **CONTROL DATA** WORLD **35**



CONTROL DATA CORP.
8100 34th Avenue South
Bloomington, MN 55425
(612)-853-8100

Mention "new strategic direction at Control Data Corp." to some people and you may have to run for cover. Years of strategic blunders and management misdirection have sown a legacy of cynicism and suspicion about this once venerable computer maker.

Dedicated customers like Walter McRae, interim director of university computing and networking services at the University of Georgia, have had their confidence in the company sorely tested. McRae was stunned by CDC's decision to drop the ETA Systems supercomputer and is now perplexed by recent announcements that seem to spell the death of the Cyber line of mainframes. "What will be the flagship product for CDC?" asks McRae. Others raise more fundamental issues. "The problem is not the product, it's management," maintains another veteran customer.

CDC believes it has addressed the management issue with the appointment of Lawrence Perlman as its new chief executive officer. Credited with turning around both the Commercial Credit Co. (sold in 1988) and CDC's storage products business (spun off as Imprimis Technology Inc. and sold last year to Seagate Technology for $450 million), Perlman takes the reins from Robert Price, who remains chairman. Perlman's stellar track record and his willingness to frankly address CDC's problems are the main reasons many analysts have put their CDC obituaries on hold.

Last year saw CDC undergo a reduction of almost unimaginable proportion. Besides jettisoning ETA and Imprimis, CDC sold off its Ticketron ticketing service, its credit-reporting services, its third-party maintenance business in Europe and the United States and also discontinued its VTC semiconductor operations. What's left—a handful of data services and the computer systems business—are expected to generate some $2 billion in revenue this year, down from $3.7 billion in total company revenues in 1985. And for the first time in years the company is awash in cash.

According to James Ousley, president of the Computer Products Division, the lower overhead and bolstered capital structure will allow CDC to survive on flat sales in 1990 while waiting for its new strategy in computers to kick in. CDC's strategy is to resell high-performance systems bought from others and enhanced with CDC systems know-how. It has inked deals with Convex Computer Corp., Cray Research Inc., MIPS Computer Systems Inc. and Silicon Graphics Computer Systems Inc.

In January 1990, the company announced the first products based on its MIPS alliance: the 4000 series of UNIX departmental computers based on reduced instruction set computing (RISC). The 4000 is a whole new price/performance category for CDC; at 55 million instructions per second, it's faster than the scalar versions of IBM's 3090-180J and faster even than CDC's own Cyber 2000, the new high end to the Cyber line, which CDC will begin shipping toward the end of this year. CDC equipped the 4000 with mainframe-like input/output (I/O) capability and is planning 10-megabyte-per-second linkups to existing Cyber systems.

By marrying the I/O and data storage capabilities of the mainframe with the price/performance power of RISC, CDC hopes to regain the ground it's been losing to Apollo Computer Inc., Digital Equipment Corp. and Sun Microsystems Inc.—and do it a lot less expensively than it could by building systems from scratch. The 4000 also signals the beginning of the end for the Cyber NOS/VE architecture. Company officials don't like to be pinned down, but by the late 1990s, they say, the Cyber will be history.

Ousley is convinced that just by recapturing business it has been losing within its existing customer base, CDC can boost annual computer sales 15% or more over the next two or three years. After the restructuring is accounted for, CDC lost $680.4 million on revenues of $2.9 billion in 1989.

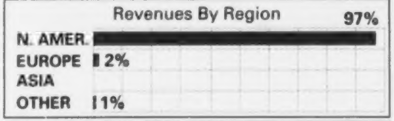
Ousley expects no revenue growth in computers this year. The reason: sales of the 4000 will be offset by a drop in Cyber revenues while customers delay purchases, waiting for the new Cyber 2000. Meanwhile, CDC is investing heavily in what's left in the data services side of the business, which includes Arbitron Co.'s audience measurement products, lottery systems and an array of business management and information services.

Are CDC's loyal and beleaguered customers convinced CDC is on the right track this time? "A year ago, everyone was asking if we [were] getting out of the business," said Ousley in March. "Now customers are asking, 'What are you going to do for me next?' I take that as a good sign."

—Joe Kelly

IS Revenues: $1.69 Billion

REGION		WORLD
17	ADP	36



AUTOMATIC DATA PROCESSING INC.

1 ADP Boulevard
Roseland, N.J. 07068
(201)-994-5000

Automatic Data Processing Inc. broke a record last year, but not one the 40-year-old company would care to boast about. ADP ended a 27-year streak of double-digit revenue and earnings increases by chalking up only a modest 8% growth rate in its fiscal year, which ended a year ago in June. Financially, the company fared even more poorly in the calendar year—inching up just over 4% on $1.7 billion in IS revenues.

Strategically, however, ADP looks to be in better shape these days. It has completely overhauled itself from top to bottom, concentrating now on four key businesses: Employer Services (ADP's traditional and largest business), Brokerage Services, Dealer Services (to automotive dealers) and Automotive Claims. The company divested four other businesses: its Real Estate processing business, which provided rent roll and accounting services; its automated teller machine (ATM) processing business, which concentrated primarily on medium-sized banks; Banking Information services, which served commercial banks and savings institutions; and a quotation services business in Canada.

"Our objective is to be No.1 in every business in which we compete," explains Arthur F. Weinbach, senior vice president of finance and administration for ADP. "We can also compete as a No.2, but with the objective to be No.1. In each of these larger, core businesses, we have the No.1 share, and we felt we could get the best returns in these areas."

The scope of services offered in each of the four key business areas has been broadened. Whereas ADP had once focused on discrete services, it now seeks to provide end-to-end services to any industry with which it does business. In Employer Services, for example, the change means providing an integrated package of services including human resources, benefits and financial services—not just payroll services.

Even as these changes were being introduced, ADP managed to achieve double-digit growth rates in both its Employer and Dealer lines of business. Employer Services grew about 15% in fiscal 1989. The on-site, PC-based part of this service grew to 40,000 installed units last year, compared with about 25,000 in 1988. In August, ADP introduced Easypay, an on-site service for companies with less than 50 employees; so far, 2,000 such systems have been installed. In addition, the company introduced a new, laser printed W-2 form, which includes information beyond basic salary and wage guidelines. Dealer Services, which provides information and on-site services to automotive dealers, also achieved double-digit growth rates in 1989, roughly equaling its 1988 growth.

In 1989, ADP broadened the scope of the services it offers.

The company's automotive business, which processed more than 5 million claims in fiscal 1989, grew only in single digits—less than its double-digit performance of the previous year. One reason for the slowdown was the lack of a handheld terminal, which a client could use to input claims. ADP remedied the problem in December 1989 by introducing such a device. Since then, the business has gone back to double-digit growth rates, Weinbach says.

Brokerage Services, still reeling from troubles on Wall Street, declined 10%, or $30 million in revenues, during ADP's fiscal period—the first time this business did not grow for ADP. Nevertheless, the company brought out three new products for this market in 1989—a new, PS/2-based front-office quotation service for two of its largest customers, Merrill Lynch & Co. and Shearson Lehman Hutton Inc.; Brokerage Plus, a mainframe-based back-office product that provides access to customer file information; and an upgrade of its Cage III transaction system. ADP says its brokerage business returned to profitability in the third quarter of calendar 1989.

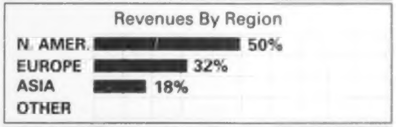
On the management side of the house, William Turner, ADP president and chief operating officer, resigned to join Forstmann Little, a venture capital company. Josh S. Weston, chairman and chief executive, picked up Turner's duties. Glenn Marschel, a 15-year ADP employee, was named president of Employer Services, and Gary Butler was named president of Dealer Services. Weinbach was elected a director of the company.

In acquisitions, a traditional method of growth for ADP, the company acquired Automatic Business Centers of Moorestown, N.J., which provides payroll services to about 11,000 companies primarily in the northeastern United States, for an undisclosed price.

—David Brousell

IS Revenues: $1.68 Billion

REGION
18
TANDEM
WORLD
37



TANDEM COMPUTERS INC.

19333 Vallco Parkway
Cupertino, CA 95014
(408)-725-6000

At a time when many computer companies are delaying product introductions because of soft market demand, Tandem keeps blitzing the industry. The company's tradition of concentrating on fault tolerant, on-line transaction-processing systems continues to pay off. Tandem's revenue for calendar 1989 was up nearly 18% to $1.7 billion; earnings also increased by 15% to $117.8 million, thereby bolstering the company's leadership position in fault tolerant computing.

Although cautious about general business conditions, Tandem expects similar growth this year. "New products will make the difference for success this year," says Bob Jolls, vice president of product marketing.

Among Tandem's more recent product introductions is the Cyclone, an online mainframe that packs IBM 3090 class performance into a price range of $2 million to $10 million; the Integrity S2, a UNIX system based on reduced instruction set computing (RISC) technology, priced between $172,000 and $248,000; and new storage and communications options for its entry-level CLX line.

Early reports indicate that the Cyclone is living up to customer expectations. "It has met all the benchmarks for our applications," notes Al Bocchetti, vice president of trading operations at the New York Stock Exchange, a beta test site and Tandem user for 11 years.

While the Cyclone represents maximum on-line power available today, Tandem realizes that tomorrow's markets may favor a more distributed environment. The company's UNIX-based Integrity S2s represent a move in that direction. In this effort, Tandem is relying increasingly on RISC technology. "This is very important to us," says Jolls. "The fundamental parallelism inherent in our systems lets us take full advantage of this technology." Other areas of increasing technological importance are fiber optics and larger database capability. The Cyclone already uses fiber optics to connect major components within the system.

Also new for the company is a major push to establish relationships with industry partners. Earlier this year, Tandem signed a major reseller agreement with Nixdorf Computer AG for the Integrity S2 and a large marketing agreement with AT&T. And in 1989, Tandem for the first time reached outside to key software suppliers for solutions that it could not supply itself. "You have to focus on doing very well the things you know best and let other specialists support you with their expertise," says Jolls.

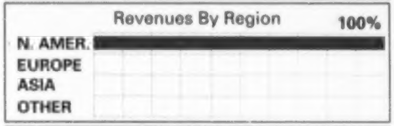
Among the agreements were several major database announcements. During 1989, Tandem signed a strategic agreement with Oracle Corp. to develop and market Oracle's database tools for use with Tandem's NonStop SQL database management software. Another agreement was signed with Sybase Inc. to license the right to develop an Ashton-Tate/Microsoft SQL Server interface to NonStop SQL.

Tandem's markets are geographically well balanced, with 50% of the company's sales being domestic, 32% coming from Europe and 18% from the Far East. This ratio has remained fairly constant for the past several years and is expected to continue.

—Kurt Rothschild

IS Revenues: $1.64 Billion

REGION
19
TRW
WORLD
38



TRW INC.

1900 Richmond Road
Cleveland, OH 44124
(216)-291-7000

TRW Inc. has gone the acquisition route to grow its information systems and services business. The conglomerate last year paid $330 million for Chilton Corp., the Dallas-based credit reporting agency.

Most of the Chilton organization was folded into TRW Credit Data Division—one of 10 entities that constitute TRW's Information Systems and Services (ISS) segment. The merger gave the segment a 31% boost in sales to $705 million and doubled its profits to $60 million. The segment now generates nearly 10% of TRW's $7.3 billion in corporate revenues—almost double its importance from a year ago.

The acquisition also gave the company information power. It now has a database covering virtually 100% of the estimated 160 million U.S. users of consumer credit. Through other operations within the information systems segment, TRW also began offering three other Chilton products, Employment Insight Report, an automated credit report that can be used for employment purposes; Social Search, a social security number search service for locating consumers; and Collection Aid, a package of services that can be used as precollection and collection tools.

A star performer in the ISS segment in 1989 was Berkeley, Calif.-based TRW Financial Systems Inc., which builds image-

Acquisitions and reorganization have boosted TRW's information power.

based information-processing systems. It signed multimillion-dollar orders with American Express Co., The Chase Manhattan Bank, MasterCard International Inc., New Jersey Bell and Pacific Bell Co. in 1989. It also signed a cross-licensing agreement with IBM under which TRW will develop distributed image-based applications to complement IBM's Image-Plus transaction system.

The company adopted a new strategy to rescue another unit of its ISS segment: TRW Customer Service Division, a 20-year-old third-party computer maintenance operation that had shrank 11% to $160 million in 1988. A growth spurt may be ahead; the division has started to provide maintenance services not only for selected products but for all computer products of multiple vendors in large user organizations. It also has maintenance agreements with high-volume microcomputer manufacturers. Marketing manager Steve Marcus characterizes 1989 as a transition year in which revenues remained flat. He forecasts a significant turnaround for the division in 1990.

The ISS segment contributed less than half of TRW's total 1989 IS revenues of $2.1 billion, up 7.6% over 1988 revenues. The $2.1 billion includes revenue from the recently formed Systems Integration Group, which combines divisions from TRW's Federal Systems Group in Fairfax, Va., and the Defense Systems Group in Redondo Beach, Calif. For the Defense Department and other government agencies, these groups provide software and systems engineering to help develop and manage hundreds of command and control centers, as well as large database management systems.

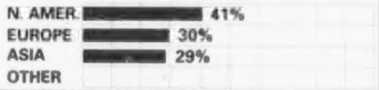
Although much of TRW's IS-related work is defense related, the company in recent years has been placing heavy emphasis on commercial applications. It operates a technology service organization, a unit aimed at commercializing TRW scientific and engineering developments.

TRW is a major player in IS, despite its relatively subdued public image in the field. In fact, it is the second largest U.S. employer, behind IBM, of system software engineers. It has about 10,000 such engineers, says Bill Nelson, director of technical management. TRW would be considered even bigger than Electronic Data Systems Corp. in professional IS services if it could count all of the work done on classified defense projects in that category. A case in point is its ESL Inc. unit, a hush-hush member of TRW's Avionics and Surveillance segment. ESL became a value-added reseller for Next Inc., selling the Steve Jobs' wonder machine to government agencies and their contractors. *—Tom McCusker*

IS Revenues: $1.52 Billion

REGION		WORLD
20	PRIME	39

Revenues By Region



PRIME COMPUTER INC.

Prime Park Way
Natick, MA 01760
(508)-655-8000

It was a tumultuous year for Prime Computer Inc., including a hostile takeover bid from Tustin, Calif.-based MAI Basic Four Inc. and the eventual emergence of a white knight in the form of New York venture capital giant J.H. Whitney & Co.

In August, J.H. Whitney acquired 79% of Prime's common stock, about 49.5 million shares, at $20 apiece. The move effectively cut off MAI at the pass. J.H. Whitney picked up the remaining shares in January to complete its acquisition.

The change in ownership didn't come without pain. In August, James F. McDonald, former head of Gould Inc., replaced Anthony L. Craig, Prime's president and chief executive officer since Joe Henson's resignation the previous October. McDonald announced a restructuring plan that included the layoff of about 2,500 people, or 20% of the work force. The job cuts came on top of 1,200 layoffs that had been announced in the first part of the year.

Prime had modest performance gains after the acquisition. Product revenue in the quarter before the acquisition was $206.7 million and $232.5 million the following quarter. All revenues for the year were down slightly, from $1.59 billion in 1988 to $1.52 billion in 1989.

With two different restructuring plans, three different presidents, (former Digital Equipment Corp. vice president Jack Shields was brought in to replace McDonald), lawsuits and financial maneuvering, it's not surprising that new products took a back seat in 1989. Still, Prime did offer some enhancements to its engineering products, including new computer-aided design (CAD) software products and new CAD workstations based on Sun Microsystems Inc.'s SPARC microprocessor technology.

The company's single addition to its flagship line in 1989—a new low-end minicomputer system for the 50 series—appeared to some as a rather weak enhancement, fueling speculation about Prime's future as a minicomputer maker.

To silence such talk, Richard Snyder, vice president of the Computer Systems Business Unit, met with users in Dallas in November and promised a more vigorous development course, including multiprocessor-based systems that will nearly double the 50's maximum performance to 56 million instructions per second. This January, part of Snyder's promises were met when a new single-processor high-end system was introduced.

Despite such continued assurances from the company, concerns about support for its traditional minicomputer line date back at least to 1988, when it acquired Computervision Corp. That purchase made Prime the second biggest computer-aided design/manufacturing (CAD/CAM) vendor in the world, behind IBM.

Following the Computervision deal, the CAD/CAM business accounted for 19% of Prime's revenues. Last year, following a restructuring that broke the company into five independent units, Prime's CAD/CAM business grew to 32% of total revenues. In the international arena, where Prime gets 60% of all its revenues, CAD/CAM was even more important, accounting for 42% of revenue.

The existing base of 50 series customers represents too much potential revenue to abandon entirely. Still, the line on Prime for the last few years is that it's using CAD/CAM as a wedge to drive itself into a smaller, but profitable, niche. Nothing in last year's turmoil appears to invalidate that view. *—Chris Sivula*

IS Revenues: $1.44 Billion		
REGION 21	CSC	WORLD 41

Revenues By Region	
N. AMER.	91%
EUROPE	9%
ASIA	
OTHER	

COMPUTER SCIENCES CORP.
2100 East Grand Avenue
El Segundo, CA 90245
(213)-615-0311

Computer Sciences Corp., one of the industry's vintage vendors, celebrated its 30th anniversary last year. But the $1.4 billion giant hardly rested on its three decades of laurels in serving the information systems industry. CSC, which grew 15% last year, instead set an ambitious course to widen its already mammoth systems integration business—widely embracing commercial users.

Government users—specifically Uncle Sam—now give CSC most of its systems integration clout. Roughly two-thirds of the company's revenues stem from government business. But as U.S. defense spending slows, so too must revenue opportunities for integrators feeding at the federal trough. Foreseeing a slowdown in government integration projects, CSC's chairman and president William Hoover reorganized the company in 1989—redirecting its focus onto the commercial horizon and shedding nonstrategic assets.

CSC's stated goal is to derive 50% of its operating profits from the commercial sector by 1994. By then, the company hopes to rank among the top two or three systems integrators in the United States and Europe. Electronic Data Systems Corp., Andersen Consulting and the integrator's arms of major systems suppliers such as IBM now best CSC in the United States in the commercial systems integration market, whereas Cap Gemini Sogeti and others have the lead in Europe.

With the commercial objective in mind, CSC launched a series of aggressive moves in 1989. Revamping its internal structure, CSC combined its Computer Partners Inc., Index Group Inc., Communications Industry Services and CSC Europe operations to form CSC Consulting, which is headed by former Index chairman Thomas Gerrity. The expanded group attracted some prime talent from Andersen during the year. One of the brightest stars in that talent galaxy was Mel Bergstein, who shot over to the CSC camp last summer after spending 21 years at Andersen as the respected leader of its worldwide information technology practice.

Bergstein's defection had to be a blow to Andersen, which was also taking its knocks from CSC in the marketplace. "We're consistently winning against Andersen," Gerrity boasts, attributing these wins to the company's all-encompassing turnkey approach. "We're not interested in just producing a black box. We're interested in making sure that whatever the box is, it fits well with the customer's business."

CSC also has decided apparently that the U.S. subsidiaries of some foreign rivals fit well with its own business. It announced a marketing alliance with SAP America Inc., the U.S. arm of SAP AG in Walldorf, West Germany, an application software vendor. Under the pact, CSC will jointly sell SAP's R/2 software, which is aimed at the manufacturing and distribution industries. It also is negotiating to buy Cleveland Consulting Associates Inc., a logistics and operations management consulting firm owned by England's Saatchi & Saatchi PLC.

CSC also has been active on the European front. In the spring of 1989, it acquired CIG-Intersys Group, the largest computer services company in Belgium. Five months later, in November, CSC bought British consulting firm Inforem Ltd.

There's a method to these mergers and moves by CSC, which is clearly signaling its strong intent to beef up its systems integration and IT consulting efforts in various vertical industry segments. "We aim to keep building our industry and application strength," confirms Gerrity, who adds that this strategy will keep CSC on the takeover trail. "We'll continue to look for attractive consulting or systems integration acquisitions in the U.S. and Europe—acquisitions that can provide us with either industry or technical expertise or with geographic coverage that complements our own."

Restructuring put Thomas Gerrity in charge of CSC Consulting.

One thing that doesn't complement CSC's new business thrust is its Infonet operation. Early last year, it reported selling off the final vestiges of its historic telecommunications service. Industry watchers opine that with this symbolic shedding, CSC is preparing to play a much more powerful role on the worldwide systems integration stage. *—Linda Runyan*

IS Revenues: $1.30 Billion		
REGION 22	DATA GENERAL	WORLD 43

Revenues By Region	
N. AMER.	51%
EUROPE	30%
ASIA	9%
OTHER	10%

DATA GENERAL CORP.
4400 Computer Drive
Westborough, MA. 01580
(508)-366-8911

There was a nice present under the tree for Data General Corp. last Christmas. A few days before the holiday, the U.S. Department of the Interior awarded Data General a $127 million contract for 6,000 Aviion workstations, a line of UNIX-based systems on which the company hopes to build its future.

DG officials are hoping the contract represents a turning point. The company hasn't had a profitable year since 1986, losing $121 million on $1.3 billion in sales in calendar 1989. After five years of cutting employees, selling facilities, reducing inventory and shrinking long-term debt at the company, management is telling customers and stockholders that the cycle of losses may be ending soon.

If DG's honchos are correct, then 1989 will be considered as pivotal a year for the firm as 1969, when it first delivered its Nova minicomputer. Not only did DG change into an open systems supplier in 1989, it also changed its leadership. Ed-son D. de Castro, cofounder and president of DG since the company's inception in 1968, removed himself from day-to-day operations—assuming the role of chief scientist and the title of chairman of the board. He handed over the operational reins to Ronald L. Skates, now president and chief executive officer.

De Castro, Skates and company are trying to blot up DG's red ink in two ways—structurally and technologically. Work force reductions, personnel reallocations and plant closings have changed the look of the company; an emphasis on standards-based products has altered its product complexion.

The company let 2,000 workers go in October and has hinted at more cuts to come. Employment, in fact, has dropped steadily at DG since 1985, when it had 16,500 workers. Today's payroll numbers 12,000. The team also chipped away at bricks and mortar last year, consolidating all U.S. manufacturing at its Apex, N.C., plant. It sold facilities in Hooksett, N.H.; Sunnyvale and Manhattan Beach, Calif.; and Singapore. And the company plans to close plants and offices in Westbrook, Maine; Portsmouth and Durham, N.H.; and Clayton, N.C.

During the second half of the 1980s, DG trimmed about $300 million from annual expenses and incurred restructuring costs of about $200 million. What resources remain are being spent on critical functions. The sales and systems engineering work force increased 13% over the past two calendar years. R&D spending over the same period increased 8% to $172 million. Yet, even with these investments, DG figures it may break even in FY1990 (ending Sept. 30, 1990) if its revenues equal those of FY1989. Skates is predicting a profit in FY1991.

DG's revenues in the future will come from two sources—its installed base of customers and new prospects. The company has installed 35,000 MV systems since the proprietary minicomputer system was introduced in 1980. And it has continually upgraded their performance; two new high-end machines, the MV/40000 and MV/40000 HA, debuted in 1989 alone. Although the company promises continued support for the MV line, it acknowledges that sales of the machines are sluggish and will remain so.

Servicing and maintaining DG's old products still generates more than $400 million in revenue a year—an important source of cash as the company makes the transition to open systems products. DG began delivering one such line of products, the Aviion workstations, in early 1989. The systems use Motorola Inc.'s 88000 reduced instruction set computing (RISC) technology and an operating system based on UNIX known as DG/UX. DG also is working on a superminicomputer-class implementation of Motorola's technology.

DG/UX is purposely designed for commercial applications—the focus of DG's efforts in the competitive world of open systems. The company has pretty much ceded technical and scientific applications—DG's strong suits a decade or so ago—to Sun Microsystems Inc. and others. Staying within the commercial focus, DG has devoted much of its resources to getting the makers of commercial applications to port their software to the Aviion line. Company officials readily admit that a lack of available software hampered the MV series and that they want to avoid a similar mistake in the future.

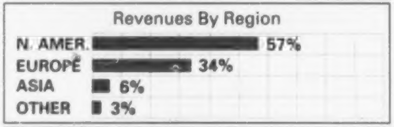
The new DG team hopes it has enough of a head start over its chief commercial UNIX rivals, IBM and Digital Equipment Corp., to become profitable again. Officials are now waiting to see if their move to open systems will prove successful. IBM's AIX UNIX-based operating system, running on its RISC System/6000 systems and other Big Blue platforms, and Digital's ULTRIX OS, running on the company's VAX and workstation systems, stand in the way of such success. Of course, IBM and Digital were there when de Castro's starting team formed the company in 1968. Time will tell his new team can beat the odds again. —*Chris Sivula*

IS Revenues: $1.29 Billion

REGION 23

COMPUTER ASSOCIATES

WORLD 44


Revenues By Region

COMPUTER ASSOCIATES INTERNATIONAL INC.
711 Stewart Avenue
Garden City, NY 11530
(516)-227-3300

"I only pursued four of the 23 companies I bought," reveals Charles Wang, chairman of Computer Associates International Inc., the largest independent software supplier in the United States. "The rest came to us when they were in the process of bellying up."

The biggest to come cap in hand to Wang in 1989 was once mighty database king Cullinet Software Inc. Wang bought Cullinet last September for $300 million, adding the Westwood, Mass., company to his existing stable of database software thoroughbreds. He had corralled Applied Data Research (ADR) a year earlier.

Both Cullinet and ADR were victims of IBM's renewed determination to dominate the database management system (DBMS) business—a key force creating acquisition opportunities for Computer Associates. Wang expects many more independent software companies from all sectors to join his fold in the years ahead because of IBM's bundling of software with its proprietary hardware and IBM's investment in selected software companies.

The cost of being the chief alternative to IBM for large scale systems application software is mounting. Spending on research and development at Computer Associates consumed 13% of revenues in 1989. Product support and enhancement has become a huge burden, now encompassing more than 210 (initially incompatible) products. And now as Computer Associates matures, revenue growth is slowing. In the fourth quarter of 1989, revenues were actually 4% lower than they were in the same quarter of 1988.

For all of 1989, Computer Associates reported revenues of $1.3 billion (restated to reflect the acquisition of Cullinet), which represents an increase of 39.8% over 1988's figures. But earnings fell 6% to $133.2 million.

Wang is not worried about slowing growth, apparently convinced that the customers who came with the Cullinet and ADR acquisitions will soon resume buying products in earnest. He's offering these customers new versions of their databases, which will run existing applications, as well as databases built with structured query language (SQL), the standard for DBMSs in the 1990s. That's a far different solution than the one IBM offers its customers who want their existing applications to be able to take advantage of SQL. They must convert from IMS, IBM's older database software, to DB2, its newer version. And they must pay separate licensing fees if they run both IMS and DB2. Computer Associates puts its solution under a single license fee.

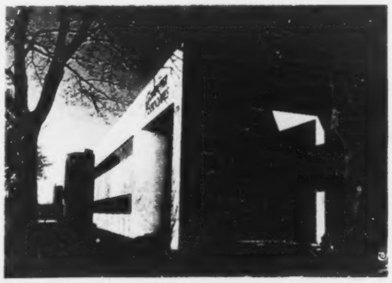
The ADR product is already available and customers expect the Cullinet version, known as IDMS 12.0, by midyear.

George Emmanuel, MIS Program manager at Hughes Aircraft Co.'s Training Support Systems Group in Los Angeles, says that he and other IDMS customers have been waiting five years for such a product. "I'm certain we [IDMS sites] will open our coffers in a big way," he predicts.

Wang also is confident that the multitude of new products introduced last year will sell well this year. The most important product, perhaps, is its Application Construction Environment (ACE), a pivotal software architecture that allows customers to develop database applications in Digital Equipment Corp., IBM and eventually UNIX environments. Other new offerings include seven new data center products and 20 enhancements to existing ones, relational extensions to CA's Masterpiece financial system and a new release of its SuperCalc5 spreadsheet software. Also unveiled was its important CA-DB:cBASE, an applications development system for relational DBMSs compatible with Ashton-Tate Corp.'s popular dBASE language.

Wang says that CA now offers ACE, CA-Datacom-DB (the company's premier relational database) and—unlike IBM—DB2 support for Ashton-Tate's program. He says there are 2 million authorized customers of dBASE and millions who aren't authorized. "Even my mother programs in dBASE," he quips.

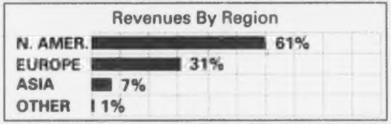
In the chairman's eyes, all available programmers must be put to work—especially those at the PC end—if the applications organizations need to compete in the 1990s are going to be built. "And we must be able to build on their work," he adds, echoing his principal theme of preserving investment in existing applications. "IBM isn't interested in doing this. There is planned obsolescence in everything it sells: a product is strategic only while it acts as a magnet for hardware sales." *—Ralph Carlyle*



CA expects to house more independent software companies under its roof.

IS Revenues: $1.22 Billion

REGION **24** **ARTHUR ANDERSEN** WORLD **45**



Revenues By Region

ANDERSEN CONSULTING
69 West Washington Street
Chicago, IL 60602
(312)-580-0069

"Can hardware suppliers deliver solutions? Can IBM and the other vendors really cast themselves as systems integrators?"

The man asking those questions is George Shaheen, who took over in 1988 as managing partner of Arthur Andersen & Co. S.C.'s consulting business, Andersen Consulting. Translated, Shaheen's questions really mean: "Can traditional vendors sell solutions instead of just pushing boxes? Are they really objective enough to be systems integrators?" Such inquiries would have been academic just a few years ago. But with software and services accounting for a larger and larger portion of every vendor's income, those questions now have the edge of a competitive taunt.

Not since Electronic Data Systems Corp. took off in the late 1960s has the service side of the information systems industry seen the kind of growth shown by Andersen Consulting. An independent business unit, Andersen Consulting has grown from less than $200 million in fees in 1980 to more than $1.4 billion for the fiscal year that ended August 31, 1989. This figure represents 43% of Arthur Andersen's total 1989 fiscal revenues of $3.4 billion. DATAMATION estimates that 85% of Andersen Consulting is IS related—putting the firm's 1989 IS revenues at $1.2 billion.

Andersen's tremendous growth—it far outstrips any of its rivals among the major accounting firms—is attributable to its willingness to go beyond traditional management consulting and strategic analysis and get its hands dirty with programming and facilities management. "Other firms are not as comfortable combining the different services under one roof," says David Lord of Consultants News, an industry analysis firm in Fitzwilliam, N.H.

The strategy apparently works well. Andersen has made its presence felt in a number of industries, from retailing (Sears, Roebuck and Co.) to heavy equipment (Caterpillar Inc.) to consumer electronics (N.V. Philips' GL).

Yet, Andersen carries particular clout in financial services. The big New York City investment banking firm, Salomon Brothers Inc., is using Andersen as the systems integrator and project manager on Fulcrum, the overhaul of its technology infrastructure. Andersen has also designed and implemented trading systems for the Swiss and German futures exchanges, as well as the Italian and French stock exchanges. In facilities management, a new business for Andersen, the company has won a contract with soap maker Dial Corp., a subsidiary of Phoenix-based Greyhound-Dial Corp.

The growth of the consulting business has generated considerable tension inside Arthur Andersen. Partners in the tax and audit units resented the tremendous growth of the consulting side, while the consultants felt they were being unfairly compensated. In 1989, Andersen separated the audit/tax and consulting businesses into two separate business units, each with its own managing partner and a new approach that ties compensation more closely to performance.

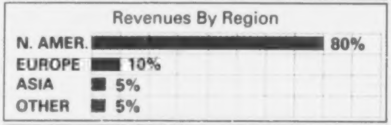
Even after the restructuring, Andersen Consulting continued to experience high-profile defections, which particularly plagued the company in 1988. Mel Bergstein, a former managing partner in charge of technology, joined rival Computer Sciences Corp. last year. The proposed merger with Price Waterhouse, a move that might have helped restore the auditing side's clout within the firm, also fell apart in September amid much talk of Price's "blue blood" culture clashing with Andersen's more "Marine-like" style. In addition, concerns were raised over the close relationship between Andersen Consulting and IBM, which is a Price Waterhouse audit client. The Securities and Exchange Commission bans joint ventures between CPA firms and audit clients.

Shaheen says that he wants Andersen to be as independent as possible, but he sees the necessity in forming close alliances between his firm and system vendors. "The marketplace is forcing everyone to declare," says Shaheen. "I can't have my firm laid victim to IBM's goals and objectives. If they see me as a competitor, they will make it harder for me to see their technology." *—Joe Kelly*

THE DATAMATION 100

IS Revenues: $1.15 Billion

REGION 25 **NORTHERN TELECOM** WORLD 47



NORTHERN TELECOM LTD.

3 Robert Speck Parkway
Mississauga, Ontario, Canada L4Z 3C8
(416)-897-9000

In October of 1988, Northern Telecom Ltd. introduced its Meridian Data Networking System, the most significant data communications product in its history and one of the most ambitious. MDNS was designed to merge disparate computers and networks into a single, centrally managed system.

But MDNS was not to be. Facing lukewarm customer reception and tens of millions of dollars in additional development costs, Northern Telecom terminated the MDNS 10 months after its introduction, throwing its data communications strategy into disarray.

However, from its 1989 financial performance, no one would know Northern Telecom had experienced any kind of setback. Earnings in 1989 rose 18% over 1988's performance (not counting the 1988 fourth-quarter restructuring costs), while overall sales were up 13% to $6.1 billion.

Northern Telecom's major business is the central office switches it markets primarily to telephone companies. Sales of these big ticket items rose nearly 12% to $3.3 billion, boosted by some large international orders. In 1989, Northern Telecom announced its FiberWorld family of fiber optic transmission and switching products for the central office market.

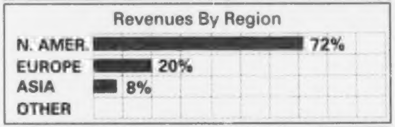
Sales of Northern Telecom private branch exchanges (PBXs), telephones, packet-switching systems and other data communications products rose 13.6% to $1.49 billion last year—the first real growth the company has seen in that side of its business since the early 1980s. Northern Telecom overhauled its PBX line in 1989, introducing Meridian 1, which integrates the company's SL-1 and SL-100 PBX systems into one modular architecture. The move, which parallels one made by AT&T with its Definity line, gives Northern Telecom customers a clear upgrade path. The software for the Meridian 1 can be configured to meet the standards of different countries, positioning Northern Telecom for growth in expanding international markets.

Northern Telecom holds just over 7% of the worldwide PBX market, which has been characterized by fierce price cutting, particularly in the United States. Consolidating its PBX line in the Meridian 1 will also enable Northern Telecom to control manufacturing costs.

The postmortems done on MDNS focus heavily on its proprietary architecture (it was based on another ill-fated Northern Telecom product, the old DV-1 minicomputer) and bad distribution. But Michael Doss, the company's vice president of marketing for data products, believes the MDNS was done in by the emergence of hybrid public-private networks. "Four years ago when MDNS was being designed, even corporate voice networks were private," says Doss, who is in charge of Northern Telecom's strategy in data communications. "Now they are hybrids. The same thing is going to happen in data. To succeed today you need to offer tools for building public and private networks." *—Joe Kelly*

IS Revenues: $982.5 Million

REGION 26 **STORAGETEK** WORLD 49



STORAGE TECHNOLOGY CORP.

2270 South 88th Street
Louisville, CO 80028
(303)-673-5151

Storage Technology Corp. is making a habit out of proving the experts wrong.

Few such experts, whether from Wall Street or Silicon Valley, gave the maker of IBM mainframe-compatible storage devices much chance of coming back from its 1984 slide into Chapter 11 bankruptcy proceedings. But not only did StorageTek come back it has rebounded so well that this year it is likely to pass the $1 billion mark in annual sales.

The company nearly reached the milestone in 1989, achieving $982.5 million in sales. That was up 11% over 1988's revenue figure. The company's earnings picture appeared to improve even more noticeably last year, as net income soared 36.5% to $47.7 million. But most of its earnings growth came from an extraordinary gain of $11.3 million garnered from the liquidation of some overseas assets. Without the gain, StorageTek's net income only would have risen 4.3%.

Similarly, most observers gave StorageTek long odds on its plans to establish a new automated tape library system as a data center storage standard. Now, two years after introducing its 4400 Automated Cartridge System (ACS) to a chorus of skepticism, StorageTek has shipped over 1,250 of the tape libraries. The product last year accounted for about half the company's sales.

StorageTek expects to ship as many as 1,400 of the libraries in 1990, as a number of current customers begin to order multiple library subsystems. San Francisco-based utility Pacific Gas & Electric Co., for example, now has five libraries and is planning to add two more. PG&E says the system has paid off in improved batch performance, space savings and lower operator head count.

The ACS could account for up to 70% of StorageTek's business in 1990. "It's carrying the corporation in a very comfortable way right now," says StorageTek chairman and chief executive officer Ryal R. Poppa.

The success of the ACS is giving StorageTek room to execute what Poppa calls the final phase of the company's recovery process: rebuilding the product line. Poppa's rebuilding strategy has two key elements. He is targeting R&D spending—8.8% of revenues in 1990—selectively. Rather than attempt to match every new storage product from IBM or other competitors, StorageTek is focusing on key products for which the company can add value. And Poppa is broadening StorageTek's market beyond the company's traditional IBM-compatible base.

Poppa, for example, has decided to bypass the current generation of IBM large disk storage devices—the 3390. Instead, he's pouring R&D dollars into the next generation of such devices. In StorageTek's case, that is a disk storage subsystem code-named Iceberg. The undercover product is being designed as a family of storage subsystems incorporating a range of disk devices, each with different price/performance characteristics. It will ship by the end of next year.

Poppa has also been busy finding new markets for StorageTek products. Al-

StorageTek's 4400 ACS tape library is a surprise hit.

though 80% of the company's products are still sold into IBM and compatible mainframe shops, StorageTek has been creating interfaces to new environments for key products like the tape library. These new environments include information systems shops populated by Control Data Corp. systems, Sun Microsystems Inc. workstations and even Cray Research Inc. supercomputers. One StorageTek customer, Apple Computer Inc., uses an ACS to automate tape storage for a Cray that helps design personal computers.

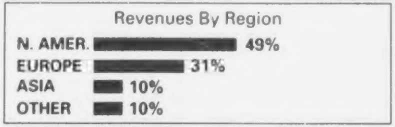
Poppa expects the non-IBM network-attached portion of StorageTek's business to grow fast, particularly with the advent of networks capable of transmitting information at 10 megabits per second and faster. In fact, StorageTek's non-IBM business is likely to grow to 50% of total revenues by the end of this decade, Poppa predicts.

"In the past, all our product planning was done by IBM," says Poppa. "Our strategy was when they announced, we announced. We got a box, we copied it. That isn't what we're doing today."

—Jeff Moad

IS Revenues: $952.8 Million

REGION **27** **MICROSOFT** WORLD **50**



MICROSOFT CORP.

1 Microsoft Way
Redmond, WA 98052
(206)-882-8080

Last year will be remembered as the year Microsoft Corp. and IBM finally acknowledged that widespread acceptance of OS/2 wasn't going to happen as fast as they thought.

But, while the slower than expected migration from MS-DOS to the new PC operating system may have hurt Microsoft's pride somewhat, it certainly didn't hurt the company's growth. Even without OS/2's success, chairman and chief executive officer William H. Gates' belief in the concept of the graphical user interface paid off handsomely through massive sales of Microsoft's Windows, the MS-DOS extension that became good enough for many a potential OS/2 convert. Last year, monthly sales of Windows swelled from 70,000 per month to 200,000.

Throughout the year, Microsoft strengthened its lead as a supplier of both systems and applications software for MS-DOS and Apple macintoshes and maintained its presence in the networking market. Microsoft's revenues climbed to nearly a third in calendar 1989 to $952.8 million from $718.6 million the previous year, while net income increased by 39% to $210.5 million.

For the first time, sales of application software as a percentage of total revenues soared past 50%, as systems software's revenue contribution slipped below 40%. That shift comes despite the fact that the company more than doubled its investment in research and development for systems software over the last 18 months. The increase in applications sales, Microsoft argues, is more a reflection of an industrywide slowdown in hardware sales than any change in emphasis by the folks up in Redmond.

Despite Microsoft's success with Windows, the company failed to deliver the new Windows 3.0 product by year's end, to the surprise of many analysts. This turn of events left other software companies that had Windows 3.0-compatible products waiting in the wings practically begging Microsoft to release the new version. At press time, it was targeted to be released in late May. Analysts agree that if Windows 3.0 lives up to its rumors as the closest thing yet to a Macintosh environment for the PC, Microsoft will ship millions of copies this year, along with another 14 million copies of MS-DOS.

Publicly, Gates & Co. is backpedaling on question of how soon OS/2 and its accompanying Presentation Manager GUI will capture the corporate world, recommending that users look instead to Windows for their first GUI. Miffed software manufacturers that had invested heavily in OS/2 applications cried foul and belatedly set to work developing Windows versions of their products.

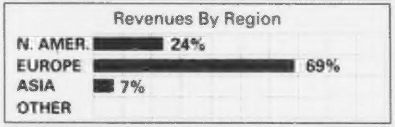
No one is saying for sure when, or even if, OS/2 will win widespread acceptance. But Microsoft can afford to be patient as it reaps in the income from Windows 3.0 and a suite of Windows applications of its own, including the Microsoft Word for Windows word-processing package announced in late 1989. "Real growth will be achieved [at Microsoft] because of this bet we made on the graphical user interface that other people didn't believe in," says Gates.

Next on Microsoft's plate is the matter of improving its networking offerings—LAN Manager and SQL Server—both of which fared disappointingly in 1989. With the recent speculation of a merger between Lotus Development Corp. and Novell Inc. into a new superpower, Microsoft finally had worries about a real competitor, especially in the networking arena. If nothing else, the merger alarm showed that at least two software companies are concerned about how big Microsoft's britches have become and how much influence Gates & Co. has on the rest of the industry.

—John McMullen

IS Revenues: $866.5 Million

REGION **28** **COMMODORE** WORLD **51**



COMMODORE INTERNATIONAL LTD.

1200 Wilson Drive
West Chester, PA 19380
(215)-431-9100

The unfriendly reception Commodore International Ltd. has been getting for its Amiga personal computer showed up on the bottom line in 1989. Demand for Commodore's older, low-end 64 and 128 PCs headed south, and neither the Amiga nor Commodore's MS-DOS computers picked up the slack. Couple that with a strong dollar—80% of Commodore's sales are recorded in foreign currencies—and you have the reasons why Commodore's sales dropped about 10% to $866.5 million and net income plummeted to $8.3 million from $69.6 million.

Commodore has new management in place trying to get the company back on track. Replacing Max Toy as the new head of U.S. operations is Harold Copperman, who joined Commodore in the spring of 1989 from Apple Computer Inc. Copperman's goal is to reposition the high end of Commodore's Amiga line to compete with the Apple Macintosh.

To boost the Amiga's image, Commodore launched a $15 million television and print campaign featuring Buzz Aldrin, Burt Bachrach, the Pointer Sisters, Tip O'Neill and other celebrities playing up the Amiga's powerful graphics and unique functions, such as editing home movies.

Having worked previously in educational marketing at IBM, Copperman is now going after the education market, as well. He sees an opportunity in Apple's efforts to get schools to switch from the Apple II to the Macintosh.

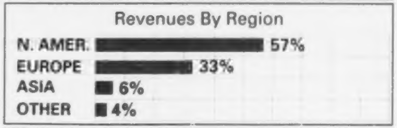
Commodore has also beefed up its lackluster U.S. distribution efforts by signing deals with the Computer Factory Inc., Computerland Corp. and the Connecting Point.

Commodore cut costs by closing its Taiwan production facility. It will now do the bulk of its manufacturing in Hong Kong, a move that is expected to save about $4 million a year. The company is also building a new automated warehouse in West Germany and is upgrading its semiconductor foundry in Pennsylvania.

As for other changes in management, Commodore has positioned new operating managers in Scandinavia, Switzerland and West Germany. These managers come with resumes that include stints at Compaq Computer Corp., NEC Corp. and Olivetti. Perhaps this new blood will give the company a boost in Europe, as it took a serious tumble in 1989 in Germany. *—Joe Kelly*

IS Revenues: $860.1 Million

REGION		WORLD
29	INTERGRAPH	52



INTERGRAPH CORP.
Huntsville, AL 35894
(205)-730-2000

As the largest company in the world solely devoted to computer-aided design and manufacturing (CAD/CAM), Intergraph Corp. faces a slew of challenges. Growth in its core market is slowing, average system prices are falling and design packages written for PCs are stealing precious market share.

Intergraph, which built its reputation putting engineering and design software on VAX minicomputers, has successfully met each one of those challenges. But it has paid the price. Gross margins on Intergraph's system sales fell nearly 3% in calendar year 1989, and the company spent heavily on more sales representatives to hawk its new 6000 series of workstations and servers. Although Intergraph's overall sales rose 7.4% in 1989, earnings took a beating, falling nearly 10% to $79.5 million.

Intergraph was late on the workstation bandwagon but has come on strong in recent years. It now claims some 6% of the market with systems based on its own Clipper reduced instruction set computing (RISC) microprocessors. Intergraph's sales in the United States were basically flat in 1989, while international sales grew 17%. The transition to UNIX contributed to slow sales in 1989. "A lot of the growth we saw in the fourth quarter was business cultivated earlier in the year in anticipation of our products being ready in UNIX," says Maurice Romine, executive vice president of corporate marketing. The only Intergraph product not converted to UNIX is software for process plant design and analysis, Romine adds.

Intergraph has waged battles successfully at the low end against the likes of Autodesk Inc. Sales of Intergraph's MicroStation software for PCs rose 72% to $50 million in 1989.

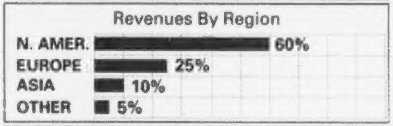
Intergraph is looking to expand its role as a systems integrator. It is a subcontractor to Boeing Computer Services on the development of the Technical and Management Information System (TMIS) for NASA's Space Station Freedom. Intergraph executives are elated not only over the price—Romine says the announced $84 million budget is likely to get much bigger—but also over the opportunity to build a large distributed database system. In another systems integration effort, Intergraph has teamed up with Bethesda, Md.-based Martin Marietta Corp. to pursue the $500 million NAVSEA contract for the design and overhaul of the Navy's ship repair and support system.

The move into systems integration is not just a defensive move to compensate for falling systems prices, says Romine. "It's not enough to just automate the architecture office," he says. "Integration across disciplines is where you really begin to see productivity improvements. Our customers are demanding it."

Eliott James, former president and chief executive officer of Quintus Computer Systems Inc. of Mountain View, Calif., a Prolog software house bought by Intergraph last year, was named Intergraph's president in October. Jim Meadlock, former president of Intergraph became CEO and chairman of the board. *—Joe Kelly*

IS Revenues: $860 Million

REGION		WORLD
30	MOTOROLA	53



MOTOROLA INC.
Motorola Center
1303 East Algonquin Road
Schaumburg, IL 60196
(708)-397-5000

Motorola Inc. thinks the conditions are right to get serious about its computer business. Although it is a leading supplier of VME bus-based computer systems, its computer group has been losing money since 1985—to the tune of some $200 million in all. But Motorola now says it is committed to making computers as important to the company as cellular telephones have become.

To back up its commitment, Motorola has come out with a line of UNIX-based workstations incorporating its 88000 reduced instruction set computing (RISC) chip. These workstations will compete directly against Sun Microsystems Inc.'s SPARCserver and IBM's RS/6000 family. Motorola is stressing its "commodity-like pricing." The new computers sell for $23,985 to $59,985 and support from three to 32 users.

Motorola says its new push in computers doesn't bother its original equipment manufacturer (OEM) customers or other companies, like Data General Corp., that use its RISC chip. And it is still committed to its Delta series of midrange computers, including the 8000 RISC model it introduced in early 1989.

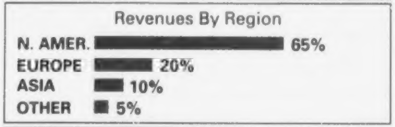
Motorola's total IS business—consisting of its computer group plus its Codex Corp. and Universal Data Systems data communications subsidiaries—racked up some $850 million in sales in calendar 1989, up 7.6% over 1988's $790 million. DATAMATION estimates that 1989 sales of Motorola's computer group sales alone were around $310 million, a slight increase from the prior year. Overall, Motorola's total company profits were up 11.9% in calendar 1989 to $498 million on revenues of $9.6 billion, compared with $8.3 billion in revenues in 1988.

Codex has been more aggressive in network management products. It introduced EtherSpan in 1989, the first in a series of products for bridging wide area and local area networks. Codex also came out with DualView, a modem add-on for managing Codex modems in an IBM NetView environment. Meanwhile, Motorola's Universal Data Systems subsidiary reported strong sales of its V32 full-duplex 9,600-baud modems.

Motorola's newest venture in data communications is its alliance with IBM on a nationwide wireless data communications service. For its part, Motorola will be providing the transmitters, handheld terminals, radio-powered modems and other devices. Analysts estimate wireless data communications services to be a multibillion-dollar market. *—Joe Kelly*

IS Revenues: $812 Million

REGION		WORLD
31	**INTEL**	55



INTEL CORP.
3065 Bowers Avenue
Santa Clara, CA 95051
(408)-987-8080

What's new at Intel Corp.? Last year, the world's premier chip maker showed increased signs of becoming a powerful performer in the computer systems business.

Although Intel once refused to talk publicly about systems revenues, Craig Barrett, Intel's newly appointed executive vice president and possible future successor to president and chief executive Andrew Grove, said early this spring that systems sales probably account for 25 to 30% of total revenues. Thomas Thornhill, who follows Intel for San Francisco-based Montgomery Securities, estimates that Intel's 1989 systems revenues were $812 million, just over a quarter of the chip maker's $3.1 billion total. He thinks that figure could rise to over $1 billion this year.

The company's total calendar 1989 revenues rose 9% over 1988's $2.9 billion. Although total profits were down nearly 14% for the year, Intel's fourth quarter income of $123 million—compared with $86 million the year before—represented a decided turnaround from the mid-1980s. During that period, the market was glutted with Intel's older chips, and revenues plunged by $265 million in 1985 and by another $99 million in 1986.

One reason for Intel's return to financial health is that it's running at near capacity to turn out leading-edge 32-bit microprocessors—the 80386 and 80486 lines—as personal computer manufacturers accelerate their demand for Intel's proprietary product family. As a result, the company has been accumulating cash that reached $1.6 billion last year, despite a $420 million outlay for new capital spending.

Intel's ongoing investment in new production facilities is beginning to pay off in both full computer systems as well as board-level and development systems. The company stepped up its systems activity in 1989 when it announced a supercomputer based on its i860 64-bit reduced instruction set computing (RISC) chip and earlier this year when it unveiled a line of 386- and 486-based UNIX workstations, called the MicroSystem line. Prices range from $6,295 to $14,595. The supercomputers are priced at $265,000 and up.

All of the systems are sold to original equipment manufacturers (OEMs) such as AT&T, which it supplies with PCs made at Intel's Systems Group in Hillsboro, Ore.

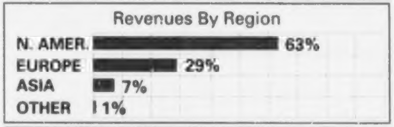
Intel's position in the systems world is causing some grumbling from its component customers, who argue that Intel is beginning to compete head-on with them. "We've been selling systems for nearly 15 years," declares Leslie Vadasz, president of the Intel Systems Group. "It's just that we are now in a more visible segment of the business—even though in the 32-bit PC field, we hold less than 5% of the market."

That apparently provides little comfort to some customers, including giant Houston-based Compaq Computer Corp. Early this year, Compaq invested between $5 million and $10 million in NextGen Microsystems, a fledgling San Jose company that is developing a chip compatible with Intel's 486 chip. Others gearing up for possible Intel chip clones include Integrated Information Technology and Advanced Micro Devices Inc. AMD dickered with Intel for a license to make the 386 microprocessor. However, Intel balked, and the issue is still in arbitration, with a decision not expected until the fourth quarter of this year.

Observers think it will be some time before Intel loses its profitable monopoly. First, any cloned chip will have to deliver a considerable performance improvement at a very attractive price. Second, Intel could litigate into the ground any attempt to step on its patented preserve. *—Tom McCusker*

IS Revenues: $784.7 Million

REGION		WORLD
32	**CRAY**	56



CRAY RESEARCH INC.
608 Second Avenue South
Minneapolis, MN 55402
(612)-333-5889

After Control Data Corp. withdrew from the supercomputer field in the spring of 1989, Cray Research Inc. remained as the only traditional supercomputer manufacturer in the United States. So what did the survivor do to take advantage of its new position? It created a competitor by slicing off a part of itself and forming a new and separate company.

In May, Cray Research announced that it would set up its founder, Seymour Cray, as head of Cray Computer Corp. in Colorado Springs and seed the new company with $150 million in cash, facilities and 200 employees. The spin-off became effective in November.

Cray Computer will continue to work on Seymour Cray's latest brainchild—the Cray-3—and market it once this gallium arsenide-based machine is fully developed sometime in 1991. The Cray-3 is expected to sell for upwards of $30 million and may offer speeds several times faster than traditional silicon chip technology now allows.

In the meantime, Cray Research will continue with the development of the Y-MP/16, the successor to its current top of the line Y-MP. A prototype of the new machine will be available in 1991, with deliveries set for 1992.

Why has Cray created a new competitor? The answer can be found in the recent financial performance of Cray Research. Signs of a slowdown were apparent in 1988, when revenues and earnings grew only 10% each. And last year, revenues rose only about 4% to $784.7 million, while earnings plunged more than 40% to $89 million. "Our strategy for 1990 is based on plans that call for revenues remaining flat this year again, and we hope that earnings will be better," says John Rollwagen, chairman.

As a result of last year's performance, Cray Research was forced to lay off 400 employees. Reasons cited by Cray for the cutbacks included increased domestic competition from Convex Computer Corp., Digital Equipment Corp. and IBM, and growing worldwide competition from Fujitsu Ltd. and NEC Corp.

With fewer projects to fund this year, Cray Research stands a good chance of improving its performance. Last year, the company spent $143 million on engineering and development, $40 million of which was lavished on the Cray-3. "The up side of the spin-off is that we are no longer funding the development of the Cray-3," says Rollwagen, "and the down side is that we lost Seymour Cray."

With the market for supercomputers charging toward lower priced units, Cray will introduce the X-MP/SE this year, priced at $2.5 million. This model uses newer integrated circuits, requires fewer parts and is less expensive to assemble than earlier Crays. *—Kurt Rothschild*

Apollo workstations bolstered HP's stand in the market.

IS Revenues: $769.3 Million

REGION **33** | **ORACLE** | WORLD **57**

Revenues By Region

N. AMER.	52%
EUROPE	33%
ASIA	10%
OTHER	5%

ORACLE CORP.
20 Davis Drive
Belmont, CA 94002
(415)-598-8000

Predicting where Oracle Corp. might go next after nearly doubling the size of its business in a single year became a popular pastime in 1989. Oracle's 1989 revenues shot up by 94% to $769.3 million, while net income grew 74% to $97.7 million.

Nevertheless, murmurs that Oracle's aggressive marketing style was pushing the company toward unsustainable growth grew louder throughout the year, only to be confirmed this March when third-quarter fiscal revenues of $236.4 million and essentially flat earnings showed growth had slowed to 73%. Oracle's stock price plummeted by 30% in a day.

Wall Street's infatuation with Oracle may be in retreat, but Oracle's diversified software and services strategy continues to hit in full force. In the fall, Oracle announced Oracle Government Financials, a family of integrated accounting packages; Oracle Financials packages running under OS/2; and a suite of manufacturing programs.

Oracle seems committed to packages for future growth. "More and more of our customers are saying that I want you to be responsible for making sure our networking software, operating systems and applications all work together," says Peter R. Tierney, senior vice president. "We see this as a natural progression in our delivering of technology."

Already, there is evidence that the company's pitch of providing portable database management software will play as well in the applications arena.

But some customers questioned Oracle's commitment to earlier offerings. The long-promised version of Oracle for Digital VAXclusters, for example, failed to materialize last year.

Oracle's primary strengths are in the minicomputer market and particularly in the Digital Equipment Corp. database arena, so how well it copes with the move toward open systems and client-server architectures will affect future growth. Already, about a third of Oracle's business is UNIX-related. "Right now, we are seeing an aggressive shift to UNIX in the midrange," says Tierney. Having launched support for Novell's Portable NetWare in February 1989 and Oracle Server for OS/2 last October, Oracle is also positioned to play across all major local area network offerings.

With about 48% of its revenues coming from overseas, Oracle is well situated for international expansion. Oracle's growing services business, now integrated under a subsidiary called Oracle Complex Systems Corp., is bringing in revenue by combining hardware, software and networking products in a single package. Future growth in the 100% range isn't likely by Oracle's own estimation. But, as long as the company can continue to balance its hyperactive growth against cash flow and customer service concerns, Oracle watching will remain a popular pastime. *—Paul Pinella*

IS Revenues: $740 Million

REGION **34** | **GENERAL ELECTRIC** | WORLD **58**

Revenues By Region

N. AMER.	50%
EUROPE	45%
ASIA	5%
OTHER	

GENERAL ELECTRIC CO.
3135 Easton Turnpike
Fairfield, CT 06431
(203)-373-2211

General Electric Information Services (GEIS), the Rockville, Md.-based computer services arm of parent General Electric Co., had a busy 1989 at home and abroad, as evidenced by new products, alliances and a change in the executive suite.

DATAMATION estimates that GEIS chalked up about $550 million in revenues, up from slightly under $500 million in 1988. GE does not break out revenues and profits for the unit. GEIS, together with the parent company's $190 million third-party computer maintenance business, gave GE information services revenues of $740 million in 1989.

Strategically, GEIS continued to pursue a five-point program consisting of electronic data interchange services as the foundation business; services and applications built on top of EDI; a vertical industry marketing thrust for these services; joint ventures and alliances; and continued investment in new technology.

GEIS added about 2,000 clients to its EDI*EXPRESS System in 1989 for a total of about 6,500 clients worldwide. Many of these new subscribers came from the retail trade and transportation industries. A new EDI service introduced last year was DESIGN*EXPRESS System, which provides for the electronic transmission of computer-aided design documents.

On the EDI alliance front, GEIS was even busier. In February, GEIS signed an agreement with Interactive Techne-Group, Inc. of Cincinnati to provide a range of computer-aided design and manufacturing (CAD/CAM) services to DESIGN*EXPRESS clients. In June, an agreement was reached with Dallas-based MicroDynamics for MicroDynamics to resell DESIGN*EXPRESS services to the sewn-goods industry. In June, GEIS was awarded a one-year contract to supply EDI services to the General Services Administration's Federal Supply Service.

GEIS entered into other value-added network services agreements last year, as well. In June, Milan-based Stet, the Italian postal, telephone and telegraph (PTT) service, acquired 40% of a GEIS affiliate in Italy that resells network services. In August, Apple Computer Inc. extended for five years an agreement under which GEIS provides network services to Apple software developers, resellers and major accounts. The service is called AppleLink. GEIS also announced an agreement with GE American Communications for Ku-band satellite transponder services.

In October, Helene Runtagh became president of GEIS, succeeding James McNerney Jr., who was reassigned to GE Capital Corp. as executive vice president. Runtagh, who joined GE in 1970, says she doesn't expect to make significant shifts in strategy, but will be putting her "own English" on a few things.

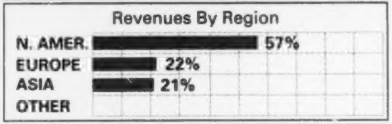
Runtagh says she will continue to introduce competitive products in all vertical markets in which GEIS does business and may even add one more—hardware and software suppliers. At the same time, she says she is interested in doing business in newly liberated countries in Eastern Europe. "Clearly, we will get into the Eastern market," she says. "The only question is when." *—David R. Brousell*

IS Revenues: $704.9 Million

REGION **35**

CONNER PERIPHERALS

WORLD **60**



CONNER PERIPHERALS INC.
3081 Zanker Road
San Jose, CA 95134
(408)-433-3340

Conner Peripherals Inc. is heading for the record books. The San Jose-based disk drive manufacturer shipped its first products in 1987. This year, the company is expected to achieve sales of over $1 billion, making it the fastest growing manufacturing company in U.S. history. Conner reported calendar year 1989 revenues of $704.9 million, way up from 1988 revenues of $256.6 million. Meanwhile, net income rose to $41.4 million, up nearly 110% from the year before.

Conner got its fast start in the disk drive business through an alliance with Houston-based Compaq Computer Corp., which helped to finance the start-up and bought most of its drives in its first year of operations. Compaq still owns 32% of Conner's shares and remains its largest customer.

Over the past three years, however, Conner has won orders from some 40 different companies, most of them in the personal computer sector. Over 40% of the company's sales are outside the United States. In Japan, Conner has been particularly successful in the burgeoning laptop market.

Conner dominates the world market for laptop drives. The company's latest products include 20-megabyte and 40MB quarter-height 3½-inch models, which are just over half an inch high, as well as an innovative 20MB 2½-inch drive. Low power consumption and high resistance to shock make the drives ideally suited for notebook and laptop computers.

"Since its inception, Conner's business focus has been to identify customer needs sooner and fill them faster than the competition," says Finnis Conner, Conner's chairman and founder. "Time to market is everything."

The company's strategy has been to work closely with its customers. While traditional manufacturers design drives, build them and then try to sell them to prospective customers, Conner designs drives to meet the specific needs of each of its customers and then builds them to order.

Critical to this business strategy is Conner's product technology. Conner tailors its drives to customers' specifications using embedded microcontroller chips that can be reprogrammed for each application. The microcode-based architecture provides Conner with increased flexibility and substantially reduces both electronic and mechanical component counts.

This year, Conner plans to expand its product line to include more high-capacity drives aimed at the high-performance personal computer and workstation segments of the computer market. The company will also begin production at a new plant in Scotland which will augment its production capacity in Italy, Singapore and the United States. The Italian operation is a joint venture with Ing. C. Olivetti & Co. SpA.

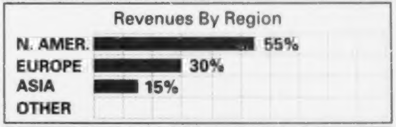
One cloud looms on the horizon. Following a dispute with its major supplier, the company is currently facing a shortage of thin film heads, the critical read/write mechanisms used in Winchester disk drives. Although Conner expects to be able to find alternative suppliers, the company acknowledges that the shortage may last until the third quarter of 1990, slowing its sales growth. *—Louise Kehoe*

IS Revenues: $696.4 Million

REGION **36**

3M

WORLD **61**



MINNESOTA MINING AND MANUFACTURING CO.
3M Center
St. Paul, MN 55144
(612)-733-1110

In the business it founded and dominates—backup tape cartridges—Minnesota Mining and Manufacturing Co. upped the stakes significantly in 1989 with a series of new products, including a cartridge capable of holding 525 megabytes, the highest capacity data cartridge available today.

3M's overwhelming position in data

cartridges—it has over 75% of the world market—gives it the leverage to keep prices stable, in stark contrast with the diskette market, where it also competes, and where intense competition has driven down prices in some sectors by as much as 60%. Santa Clara Consulting Group, which follows the media market, estimates that data cartridges accounted for well over half of 3M's $631.4 million sales of magnetic media products in calendar 1989, up nearly 12% over 1988's figures.

In addition to its new cartridges, 3M has provided tape drive manufacturers with a prototype of a cartridge capable of storing more than 1 gigabyte of data. Charles Calisto, marketing manager for data products at 3M, says the 1GB cartridge will be introduced this year.

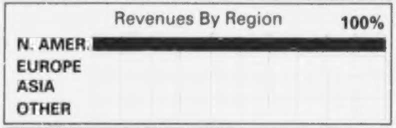
In 1989, 3M bought the 116,000-square-foot plant that IBM built in Tucson, Ariz., to manufacture 3480 tape cartridges. 3M has been selling its own Black Watch brand of the 3480 cartridge since IBM introduced the 3480 system in 1984. It now manufactures the Black Watch brand at the Tucson plant, as well as cartridges for IBM. In January of this year, 3M introduced its new Royal Brand tape cartridge for the IBM 3480/3490 systems.

3M is also involved in information systems through its Health Information Systems (HIS) group, which provides systems and services for hospitals, laboratories and medical groups. 3M's HIS group includes such product lines as Code 3, Med-Lab and Health Evaluation Through Logical Processing (HELP), which was acquired in 1987. DATAMATION estimates the group's 1989 sales to be around $65 million.

—Joe Kelly

IS Revenues: $687.6 Million

REGION **37** | **BLACK & DECKER** | WORLD **63**



BLACK & DECKER CORP.
701 East Joppa Road
Towson, MD 21204
(301)-583-3900

This is Black & Decker Corp.'s first year on the DATAMATION 100 list—and probably its last. The reason: The world's No.1 maker of power tools and a leading supplier of household products with $3 billion in sales wants to get out of the computer business.

Last July, Black & Decker acquired Emhart Corp., a $2.8 billion manufacturer of faucets, locks and lawn equipment. And along with Emhart came Emhart's newly established computer operation called the Information and Electronic Systems (IES) sector. IES was the result of Emhart's acquisition of two Virginia-based companies—Advanced Technology Inc. and Planning Research Corp.—which provide computer services to the government. Now operated as a separate unit by Black & Decker, IES is up for sale so that management can retire debt and focus on its core businesses.

Despite a decline in federal and defense spending growth, IES reported 1989 revenues of $704 million, compared with $656 million in 1988. Major new orders include a 10-year contract worth $150 million from the Navy to provide systems integration, software development and support services to the Navy's engineering data management operation. Another contract, for $7 million from the Department of Transportation, is for systems integration services to the Coast Guard. Much of last year's business came from extensions to major contracts, including the automated patent system developed for the U.S. Patent and Trademark Office, which is the largest automated document management system in existence.

Probably due to a dim outlook for growth in the government sector, Black & Decker is delaying plans to sell IES, for which the company once hoped to fetch some $500 million. But it may be forced to sell next year when the company's next debt repayment is due. Agreements with the banks from which Black & Decker borrowed nearly $4 billion require a $450 million debt reduction by this summer. The company will pay for this through the already-completed sale of an adhesives business and two smaller manufacturing divisions for $500 million.

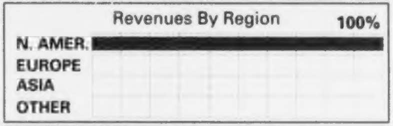
In 1991, the company must retire another $240 million in debt. Analysts speculate the firm may sell its computer division at that time. Black & Decker isn't commenting.

In fact, the only mention of IES in the company's annual report is that the division is for sale. Whereas last year Black & Decker operated IES almost as if it were two separate companies, in early 1990 it took steps to further consolidate its computer division, a ploy that may serve to attract future suiters. Early this year, the company named Wayne Shelton, former president and chief executive officer of planning research, as IES chairman, and Advanced Technology's former president and CEO, Scott Thompson, as president and CEO of the combined unit.

—Tom McCusker

IS Revenues: $660 Million

REGION **38** | **AMERICAN EXPRESS** | WORLD **65**



AMERICAN EXPRESS CO.
American Express Tower
World Financial Center
New York, N.Y. 10285
(212)-640-2000

In its credit card business, American Express Co. strives to stand apart from the competition by providing its card holders with a high level of personalized service. In its information systems business, however, the company aims for efficiency—processing high-volume back office jobs for hundreds of banks, mutual funds, hospitals, cable TV companies and other information-intensive enterprises at as low a cost and high a quality as possible.

American Express has been doing back office processing since the early 1980s, when it purchased First Data Resources Inc. Over the years it has acquired several other businesses, and in 1989 it established them as the American Express Information Services Co. (ISC), one of five major operating units of American Express.

In calendar year 1989, ISC posted sales of $660 million, up nearly 50% over 1988, but still a small part of American Express' $25-billion financial services empire.

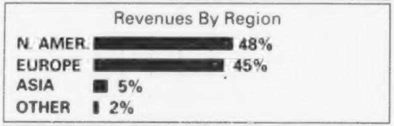
The large growth in ISC was due largely to acquisitions, including the purchase of the Health Systems Co. from McDonnell Douglas Corp. The Health Systems Group of ISC provides processing services and turnkey systems to more than 800 hospitals in the United States, including Puerto Rico.

The ISC's main business is credit card processing. Through its First Data Resources operation, the ISC is the largest third-party processor of debit and credit card transactions, including accounts for Visa and MasterCard (but not the American Express Card, which is handled by American Express Travel Related Services Co.). The volume of bank card transactions handled by the ISC rose 25% during 1989, compared with 20% growth in 1988, thanks in part to the acquisition of the Eastern States Bankcard Association.

The ISC also processes mutual fund accounts. It got into that business in June of 1989 by buying the Shareholder Services Group of The Boston Company, which is part of Shearson Lehman Hutton, another American Express operating unit. In January of this year, ISC also acquired the mutual fund transfer agency of Mellon Bank NA, pushing the number of accounts ISC services to 6.5 million. *—Joe Kelly*

IS Revenues: $590 Million

REGION		WORLD
39	**LOCKHEED**	66



LOCKHEED CORP.
4500 Park Granada Boulevard
Calabasas, CA 91399
(818)-712-2000

Lockheed Corp. built a stable of information services, software and computer graphics firms through acquisitions in the early 1980s, but now it wants out of information systems. Lockheed announced last year it was pulling out of IS to concentrate on getting all it can out of the shrinking defense business. In addition, Lockheed has been under attack by corporate raider Harold Simmons, who wants to take control of the company. In calendar 1989, Lockheed's overall corporate sales fell 5% to $9.9 billion. Earning dropped precipitously, to $2 million, down from $624 million in 1988.

Lockheed sold off Dialog Information Services to Knight-Ridder Inc. in 1988, and last year it unloaded CADAM Inc., its computer-aided design (CAD) software firm, to IBM. Lockheed's sale of CADAM became a hot item when some Japanese firms evinced interest in it. Since many of IBM's CAD customers use CADAM software, it was important for IBM not to let the company fall into the hands of a major competitor. Lockheed couldn't get its asking price for CalComp, the computer graphics firm that came with the 1986 acquisition of Sanders Associates Inc., so the defense contractor decided to hang on to what has always been the biggest and most profitable part of its IS business.

Also still on the block is Metier Management Systems Inc., a leading vendor of project management software, which Lockheed acquired in 1985. Including CalComp, Metier and Datacom Systems Corp., which supplies services to state and local governments, Lockheed's IS revenues were about $590 million in 1989.

CalComp struggled to achieve overall sales of $480 million, which represents growth of about 13% in calendar 1989. The company saw strong demand in Europe, which accounts for about 45% of its sales, but business at home was hurt by a drop in business from IBM, CalComp's biggest original equipment manufacturer (OEM) customer.

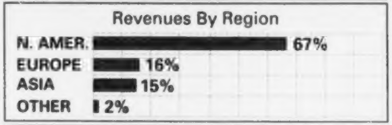
Larry Sanders, CalComp's senior vice president of sales and marketing, says the slowdown in the CAD market and pressure to keep pace with the declining cost of workstations put pressure on CalComp in terms of how much it could charge for its plotters and digitizers. (CalComp sells only peripherals, having jettisoned its systems division in 1987.) According to Sanders, during the past five years the average selling price of a plotter has dropped 80%.

DrawingMaster, a wide-format thermal plotter that CalComp introduced last year for $15,000, is a lower cost alternative to laser or electrostatic devices. CalComp is also going after the business presentation market with its Wiz mouse system, which combines a mouse and digitizer pad. *—Joe Kelly*

Texas Instruments adds information services to its repertoire.

IS Revenues: $585 Million

REGION		WORLD
40	**TEXAS INSTRUMENTS**	67



TEXAS INSTRUMENTS INC.
13510 North Central Expressway
Dallas, TX 75243
(214)-995-2011

How can you tell that Texas Instruments Inc. today is a different company from the battered giant that president and chief executive officer Jerry R. Junkins took control of five years ago? One way is to look at the company's annual report. Contrary to TI's tradition of black-and-white graphics, the 1989 report features a color photograph on the cover. This small change is symbolic of the changes Junkins has wrought on a corporate culture that tended toward arrogance in years past.

Now, the Dallas-based computer company is listening to customers and competitors alike. Last year TI signed an agreement with General Motors Corp.'s Delco division to produce automotive sensors and began working with IBM on manufacturing automation projects. It also helped United Airlines Inc. develop a sophisticated gate assignment system based on TI's expert systems technology. TI reported IS revenues last year of $585 million, which is less than 10% of TI's total 1989 revenues of $6.5 billion.

A huge corporate restructuring last September brought about substantial changes in the way TI approaches IS. Several disparate business entities were merged to form the Information Technology Group as a way to refocus priorities on software and consulting. The new group was placed under the guidance of vice president John W. White, TI's former information systems director.

The group is in the midst of making a transition to industry standards, away from proprietary operating systems of the past. While TI will continue to support established customers, industry standard products—such as the MS-DOS laptop computers introduced in October—will likely become more common. Meanwhile, TI will continue nurturing its growing UNIX business through a family of multiuser systems based on Motorola

Inc.'s 68030 microprocessor.

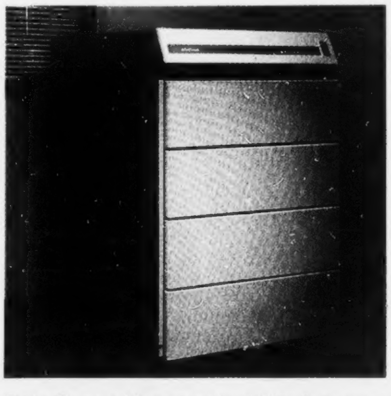
TI predicts that by 1995 more than 50 to 60% of the Information Technology Group's revenues will come from software and consulting services. Currently, more than 80% of the group's sales come from hardware.

On the semiconductor side, TI has been working to stay competitive. Through joint ventures last year, the company was able to build expensive semiconductor plants after making arrangements with governments overseas to give it access to cheaper capital.

TI formed a joint venture in Taiwan with Acer Inc., whereby Acer supplies most of the money and TI furnishes the expertise to build a $250 million microelectronics factory. In Italy, TI received $100 million in government incentive loans and is starting out as the majority owner of a new $250 million facility. In March of this year, TI entered into its largest joint venture, a deal with Kobe Steel Ltd. of Japan to build a $350 million factory dedicated to the production of application specific integrated circuits (ASICs). Even with these agreements, TI has yet to match the low capital costs of most firms in Japan.

However, TI's Japanese future looks bright. Last year, following years of litigation, the Japanese government's patent office handed down a favorable ruling to TI, granting it a patent for an original semiconductor design. Some analysts estimate that the ruling could produce up to $2 billion worth of revenue for the Texas company.

One big question remains with regard to TI's profitable defense electronics business. With cutbacks likely in many defense programs, TI could feel the effects in the months and years ahead. *—Bob Francis*



Data General hopes to build its future on Aviion.

IS Revenues: $556 Million

REGION		WORLD
41	LOTUS	70

Revenues By Region

N. AMER.	59%
EUROPE	32%
ASIA	8%
OTHER	1%

LOTUS DEVELOPMENT CORP.
55 Cambridge Parkway
Cambridge, MA 02142
(617)-577-8500

Old habits are hard to break. That's what such industry luminaries as Microsoft Corp.'s Bill Gates and Computer Associates International Inc.'s Charles Wang discovered when they tried to lure Lotus' 1-2-3 customers away to the promised land of their spreadsheets. For, despite highly publicized delays in replacing its five-year-old 1-2-3 release 2.01, an array of development problems, departures of marketing and development talent and a crimp in its 1988 earnings and sales, Lotus' customers stayed with their tried-and-true package until its successor, the long-awaited release 3.0, finally surfaced last summer.

The problems, though, didn't seem to hurt the company's calendar 1989 earnings prowess or its spreadsheet market share, which remained at about 70%, according to analysts. Sales, meanwhile, climbed 19% to $556 million last year, and net income was up 15% to $68 million, completely reversing the 18% net profit decline of 1988.

The availability of 1-2-3 release 3.0, which was written in C and enhanced with a variety of features such as access to remote database management systems, three-dimensional spreadsheets and presentation quality graphics and output, did not come without a price. Release 3.0 runs only on 286-based PCs and up, with a minimum of 1 megabyte of memory—that is, on only about 65% of PCs sold today, according to experts. Thus, ironically, the biggest competitor to release 3.0 may be the new release 2.2, an interim, updated version of release 2 that runs on 8088/8086-based PCs.

Release 3.0 was but one of the products Lotus rolled out last year. Others included a 1-2-3/M for mainframes; a 1-2-3/G for OS/2 and Presentation Manager; and, in an agreement with Tandy Corp., a new version for the largely unpenetrated small-business and home computer market, Lotus-DM. Also, in its bid to make 1-2-3 available on all leading hardware platforms, Lotus is working on DEC VMS and industry standard UNIX versions.

Business professionals use three tools for their analysis and decision making: spreadsheets, databases and graphics. Lotus' strategy in a nutshell is to integrate and enhance the three at all possible levels to create what chairman Jim Manzi refers to as the industry's preeminent "analysis engine." Since delivering data to the desktop is the vital first step in its plans, Lotus has targeted the communications and DBMS portions as most strategic to its goal.

On April 6th this year Lotus signed a letter of intent to merge with LAN leader, Novell Inc. of Provo, Utah. The merger was expected to be completed in July, but talks fell apart in May. Lotus was to have a 51% stake of the new company, operating Novell as a wholly owned subsidiary. Novell has in the neighborhood of 60% of the LAN business and had sales of around $422 million in 1989.

Lotus last year acquired 15% of the innovative relational DBMS concern Sybase Inc. of Emeryville, Calif. and has an option to increase its stake to 25%.

—Ralph Carlyle

IS Revenues: $539.8 Million

REGION		WORLD
42	SHL	71

Revenues By Region

N. AMER.	95%
EUROPE	5%
ASIA	
OTHER	

SHL SYSTEMHOUSE INC.
50 O'Connor Street, Suite 501
Ottawa, Ontario, Canada K1P 6L2
(613)-236-9734

The major suppliers of mainframe and minicomputer systems aren't the only ones being forced to accommodate the power of personal computers, workstations and the networks connecting them. Distributed-computing technology is making systems integrators broaden their focus beyond the traditional mainframe operating environment.

Acquisitions have proved to be the broadening experience needed by SHL Systemhouse Inc., Canada's biggest systems integrator and the largest Canadian firm entirely devoted to information systems. Its purchases of ComputerLand Canada and Computer Group PLC in Britain have given the company enough revenues to crack the DATAMATION 100 for the first time.

"The acquisition of ComputerLand enables us to provide complete end-to-end support in today's new environment in the same way the traditional systems integrator provided mainframe support," explains Peter A. Sandiford, president and chief operating officer of Systemhouse. The acquisition of ComputerLand Canada, which took place in late 1988, coupled with the 1989 purchase of Computer Group, more than doubled Systemhouse's sales from $240 million Canadian dollars ($194 million) in calendar 1988 to C$639.1 million ($540 million) in 1989.

Although retailers typically aren't included in the DATAMATION 100, ComputerLand Canada is a worthy exception. Unlike most retailers, it always has focused primarily on serving corporate customers. Although ComputerLand Canada continues to operate independently, its parent is already depending on the subsidiary's PC expertise in several major contracts. One is the fire department dispatching system that Systemhouse created for the city of Los Angeles. The system is based on IBM PS/2 microcomputers and Motorola Inc. Mobile Data Terminals.

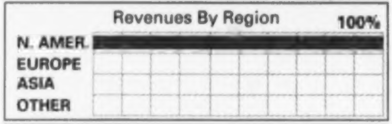
As a systems integrator, Systemhouse has eschewed the popular strategy of focusing on specific niche markets, such as financial services or manufacturing. "Our view is that we are called in to provide innovative applications of technology," explains Sandiford. "Our clients come to us to reduce the risk and time it takes to implement innovative systems."

Systemhouse's sales have traditionally been divided equally between the United States and Canada. In the late 1980s, the company made a big push to get more business from the U.S. federal government, but it is now feeling the effects of the heightened competition in that market, exacerbated by spending cutbacks in Washington.

Systemhouse is likely to be one of the most talked-about systems integrators of 1990 because Kinburn Technology Corp., a management holding company that owns 50.1% of the stock of Systemhouse, became strapped for cash in late 1989 and put its majority stake in the company up for sale. —*Joe Kelly*

IS Revenues: $502.2 Million

REGION 43 | **MARTIN MARIETTA** | WORLD 73



MARTIN MARIETTA CORP.

6801 Rockledge Drive
Bethesda, MD 20817
(301)-897-6000

Despite record corporate revenues of $5.8 billion, 1989 was not a good year for Martin Marietta Corp.'s Information Systems Group (ISG). The division's revenue from non-Martin Marietta business plummeted 32% in fiscal year 1989 to $502.2 million, after increasing nearly 10% in 1988. The company says the big decline was mainly due to 1988 revenue figures inflated by the sale of British subsidiary Hoskyns Group PLC and the completion of a communications systems contract.

Tightening federal budgets and enormous changes in Eastern Europe and the Soviet Union have left few defense contracts on ISG's plate. The division continued work on a five-year, half-billion dollar pact to develop and operate the National Test Bed, a computer simulation network for the Strategic Defense Initiative, but dwindling defense dollars have forced ISG to look elsewhere for work.

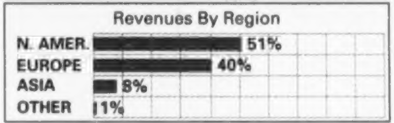
One area the company has looked to is the air traffic control business. ISG completed close to 30 air traffic control modernization projects in 1989. The projects ranged from surveillance radar systems that manage takeoffs and landings at airports to new wind shear alert systems installed in Denver and New Orleans. A similar contract was awarded to ISG by the Department of Defense for modernizing military air traffic control systems. And the company also installed 31 automated weather observation systems last year—the first of 1,000 systems the company will install over the next 10 years.

After winning a contract from the U.S. Postal Service, ISG entered a new market—automated mail-sorting machines. The division will manufacture and install 267 sorters in postal offices throughout the country. The company also won a contract to supply software services to the Social Security Administration's data-processing facility in Baltimore and to the National Agricultural Statistics Service of the U.S. Department of Agriculture.

ISG also looked to air traffic control contracts outside the United States to fill the void left by shrinking dollars at home. In Canada, ISG completed modernization of the Canadian air traffic control system. Also, Martin Marietta was awarded a technical study contract by the Eurocontrol Experimental Center in France, which advises many European countries on air traffic control. Through ISG, Martin Marietta will assist the center in improving computer simulation methods for air traffic management. —*Mike Ricciuti*

IS Revenues: $495 Million

REGION 44 | **NYNEX** | WORLD 74



NYNEX CORP.

1113 Westchester Avenue
White Plains, NY 10604
(914)-644-6000

Among all the Bell operating companies, NYNEX Corp. goes the furthest to stake out a clear position in information systems, thanks in large measure to an ongoing series of acquisitions. In 1987, NYNEX bought Business Intelligence Services, the British banking software firm, and a year later acquired Mountainside, N.J.-based AGS Computers Inc., which offers software and services primarily to financial institutions.

Those two companies combined are now the mainstays of NYNEX's Information Solutions Group (ISG). Last year, ISG's revenues hit $495 million, up from $430 million the year before, but still just a fraction of NYNEX's overall 1989 revenues of $13.2 billion.

NYNEX stayed on the acquisition trail in 1989, adding two more software and services firms: Tampa, Fla.-based Teco Technologies Inc., which serves utility companies, and LeRoux, Pitts and Associates Inc., a Clearwater, Fla., firm specializing in point-of-sale applications for banking, retail and government clients. Since the mid-1980s, NYNEX has built up ISG through over a half-dozen such acquisitions.

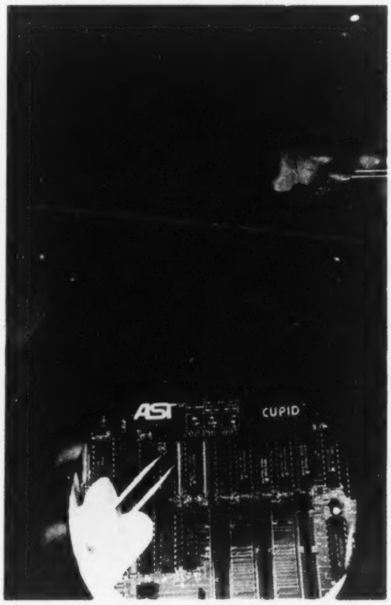
ISG's biggest piece of business to date

is Empire Net, the $180 million voice/data network it is helping put together for New York state. Yet more recent contracts have also been significant. Last August, NYNEX picked up another $33.5 million deal to install automatic payment systems for the parking lots of the three major New York City area airports. Both Tandem and LeRoux, Pitts are subcontractors on that contract.

Another significant contract was secured by NYNEX Computer Services, a division of ISG, to manage the network of computer facilities and data communications services that support the delivery of the PRODIGY service in the NYNEX area. PRODIGY is an on-line information service delivered through Prodigy Services Co., a joint venture between IBM and Sears, Roebuck and Co. in White Plains, N.Y.

Although over a third of its business is with banks and securities firms, ISG has not been hurt by the downturn in financial services, maintains Engkvist. "[Financial companies] are still spending a lot to strengthen their internal systems," he says. Fortunately for NYNEX, much of that spending is still coming from a healthy overseas market. ISG, which does about 35% of its business internationally, is even benefiting from the opening of the Eastern Bloc—last year, NYNEX sold two banking systems in Hungary.

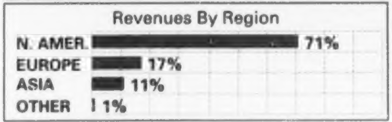
—Joe Kelly



AST keeps a close eye on research technology.

IS Revenues: $482 Million

REGION **45** **AST RESEARCH** WORLD **76**



AST RESEARCH INC.
16215 Alton Parkway
Irvine, CA 92713
(714)-727-4141

What a difference a year makes. As AST Research Inc. entered 1990, it was coming off a quarter in which it made $7.4 million and a year in which it positioned itself as a leading supplier of personal computers. A year earlier, it had faced an $8.9 million quarterly loss in an uphill struggle to become something more than a supplier of enhancement boards for all types of desktop systems.

The company is still in the board business, but the bulk of its sales now come from complete systems. It has limited its enhancement products to IBM and IBM-compatible PC enhancement boards, selling off operations that make boards for systems manufactured by Apple Computer Inc. and Digital Equipment Corp. Its chief focus—and the source of nearly 85% of its $482 million in revenues in 1989—is building and making PCs.

The major introduction of the year for the company wasn't a new product. It was a new blueprint for its future PC products based on the Cupid-32 architecture. The design, unveiled in January 1989, allows users of AST PCs to switch from their old microprocessors as more powerful microprocessors become available. Such flexibility enabled the company to be among the first to ship systems with Intel Corp.'s 80486 microprocessor. By the end of the year, the company's best-selling computers were its 80386-based machines, which accounted for 60% of company sales in the fourth quarter of 1989.

Like PC-compatible rival Compaq Computer Corp., AST markets its PCs chiefly through retailers and other resellers. Unlike Compaq, it also sells systems to other computer companies—such as Tandem Computers Inc. and Texas Instruments Inc.—for resale. Such original equipment manufacturer (OEM) customers constitute about 8% of AST's sales.

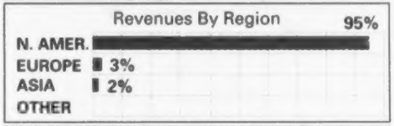
Nearly a third of AST's revenues now come from outside the United States, including a heafty 10% of total sales coming from the Far East. Access to Japan and other Far Eastern markets is made all the easier by AST's investments in manufacturing plants in Hong Kong and Taiwan. In fact, about 70% of all the PCs sold worldwide by AST are made in the company's Taiwan plant.

Potential products for the future include a PC-based network server machine, possibly with dual processors and similar to the Compaq SystemPro; a laptop computer; and a workstation based on reduced instruction set computing (RISC) technology.

—Bob Francis

IS Revenues: $479 Million

REGION **46** **SCIENCE APPLICATIONS** WORLD **77**



SCIENCE APPLICATIONS INTERNATIONAL CORP.
10260 Campus Point Drive
San Diego, CA 92121
(619)-546-6000

Among the contracts Science Applications International Corp. (SAIC) garnered last year was one from the Veterans Administration for a network that will tie all the agency's hospitals and offices together. The $84 million contract has options that could double it in value. Another contract was from the Federal Aviation Administration for bomb detectors to screen luggage at airports for plastic explosives. The $20 million contract could grow larger as more airports install the $1 million systems.

These types of contracts typify SAIC's efforts to reduce its dependence on U.S. government defense contracts as its main source of revenue. "Our strategy is shifting, to get more heavily involved in the nondefense government area and, to a smaller degree, in commercial business," says Jim Russell, senior vice president of corporate business development at SAIC's office in Virginia Beach, Va.

Defense work still accounted for nearly two-thirds of SAIC's more than $1 billion in total corporate revenue in calendar 1989. And the United States remained the company's biggest geographic market—contributing 90% of its revenues. Of SAIC's total corporate revenues, $479 million were IS sales—up from $386 million a year ago, when the company's total sales reached $865 million.

SAIC is an employee-owned company organized into four separate business areas: national security; environment and health; energy; and high-technology products. The company's 11,500 owners consult, engineer systems, analyze programs and integrate systems. And the businesses have done well, bringing the company up from its $150 million start in the 1980s.

SAIC expects to grow 15% in 1990 and regards the environment and energy areas as particularly promising. The company's computer software and telecommunications capabilities are considered to be the critical technologies necessary to continue SAIC's rate of growth in traditional markets as well as in its newly developing spheres. *—Kurt Rothschild*

IS Revenues: $452.3 Million

REGION		WORLD
47	WYSE	78

Revenues By Region

Region	Share
N. AMER.	65%
EUROPE	25%
ASIA	5%
OTHER	5%

WYSE TECHNOLOGY
3471 North First Street
San Jose, CA 95134
(408)-473-1200

Wyse Technology has been a corporate survivor ever since the company's upward spiral thudded down to earth two years ago. Many observers predicted that the successful terminal and monitor maker would beat a quick retreat from the PC business after it sank into a wave of red ink in 1988.

Last year, Wyse weathered a tumultuous time amid rumblings that all or part of the company would be sold. For the third fiscal quarter, which ended December 29, 1989, Wyse reported a net loss of $7.1 million on quarterly revenues of $112.4 million, a slight improvement from the financial hemorrhaging earlier in the year. For calendar 1989, Wyse posted revenues of $452.3 million and a loss of $21.2 million.

By 1990, Wyse had also made improvements to its product family, successfully making the transition to 386 PCs and centering its computer lineup on a newly introduced flagship entry level 286-based model. Wyse even managed to increase its share of the market for general purpose terminals to 48% in 1990.

By year's end, the rumored friendly takeover by Channel International, a group of Taiwanese investors, materialized with a tender offer that was accepted in January 1990. Channel International bought Wyse for $164.5 million and took it private. Morris Chang was installed as chairman and chief executive officer of the company, replacing former Wyse chairman and CEO Bernard Tse, who became vice chairman. C. Daniel Wu, the new president, was brought in to manage the day-to-day affairs, but the rest of Wyse's management team remained for the most part intact.

The new Wyse shot out of the chute in 1990 with the fruition of a three-year project that catapulted it into the multiuser UNIX systems marketplace. As a result of that contract, Wyse introduced two multiuser, multiprocessor machines for distributors, along with its own version of UNIX System V/386. Designed for as many as 128 users, each system employs up to six Intel 836 processors. An optional board is available for upgrading the systems with 486 chips.

Selling advanced systems exclusively through distributors will certainly test Wyse's mettle during 1990. But if the company can continue to leverage its acknowledged strengths—low-cost, Taiwanese manufacturing and quality U.S. engineering—it could regain its former market luster. *—John McMullen*

IS Revenues: $450 Million

REGION		WORLD
48	DUN & BRADSTREET	80

Revenues By Region

Region	Share
N. AMER.	80%
EUROPE	20%
ASIA	
OTHER	

DUN & BRADSTREET CORP.
299 Park Avenue
New York, NY 10171
(212)-593-6800

For blue chip information services provider Dun & Bradstreet Corp., it was a year of cautious optimism.

In calendar year 1989, the company's revenues grew slightly to $4.3 billion, up from $4.2 billion the year before. Meanwhile, net income increased more than 17% to $586 million from $499 million the previous year. Although earnings met D&B's expectations, officials hint of a possible earnings decline in 1990, based largely on softness in the company's credit services sector.

Digital's data center in Marlborough, Mass.

D&B's marketing research information business plays a major role in the company's global strategies. This business includes Nielsen Marketing Research, which provides point-of-sale consumer response for manufacturers and retailers, and Nielsen Media Research, which serves TV advertisers and networks. Donnelley Marketing, a direct-marketing agency, also figures prominently in D&B's global strategy, as does IMS International, which serves the pharmaceutical industry by providing competitive marketing data.

"For our customers, the battle for their customers' revenue is becoming more real-time," says Robert Weissman, president and chief operating officer of D&B. "That's driving the demand for more real-time information systems both internally [for them] and from external information service vendors like us."

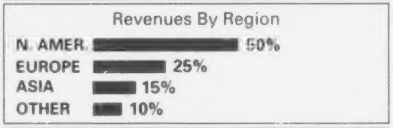
Another of D&B's mainstays continues to be its credit risk management service. "That's a business that [by itself continues] to do well—over half a billion dollars worth of revenue a year," says Weissman.

Perhaps the best candidate for long-term growth potential lies with D&B's newest division, Dun & Bradstreet Software Services, comprising former applications software leaders McCormack & Dodge Corp. of Natick, Mass., and Atlanta-based Management Science America Inc. (MSA), which D&B acquired last November. John Imlay, chairman of D&B Software and former chairman and chief executive officer of MSA, expects the software group to generate $450 million in 1990, about the same as it did in 1989, and to grow at the industry rate of 15% per year after that. For the short term, he says the emphasis will be on contined improvement of the existing product lines. "You have two major presences in the mainframe software markets with some 10,000 customers combined," says Imlay.

Customers are now waiting for Dun & Bradstreet Software Services to produce a promised next generation of software that blends the two product lines. According to Imlay, the first fruits of this new generation will be ready in about three years. Afterwards, the company will help customers embark on a five-year migration process. Says Imlay: "95% of our combined customer base is IBM mainframes, so the priority will be on developing SAA- [Systems Application Architecture] compliant software, with secondary focus on open systems and UNIX." D&B's real challenge in the short run will be to bring together two very tough competitors and mold them into a well-managed, efficient organization. *—John McMullen*

IS Revenues: $450 Million

REGION		WORLD
49	**ERNST & YOUNG**	79


Revenues By Region

ERNST & YOUNG
787 Seventh Avenue
New York NY 10019
(212)-830-6000

Accounting firms have been playing at the edges of the IS world for most of the 1980s. Only Arthur Andersen & Co. had built the critical mass to be a major player, but now there is Ernst & Young. Ernst & Young was formed in 1989 from the merger of Ernst & Whinney and Arthur Young & Co., one of two mergers that turned the Big Eight into the Big Six. (The other was Deloitte Haskins & Sells and Touche Ross & Co., which became Deloitte & Touche in December.)

Because the growth of auditing and tax consulting has slowed considerably in recent years, management consulting is a key avenue for continued growth. At Ernst & Young, management consulting was a $750 million business in calendar 1989, with information consulting and services accounting for some $450 million.

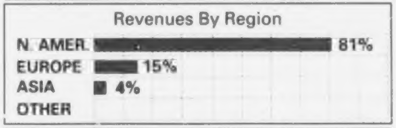
Both firms were engaged in consulting before the merger. Ernst was by far the larger of the two and, in contrast to Young, drew many of its consulting customers from among its auditing clients. The ability to offer a full set of integrated services in both auditing and consulting is going to be an important part of Ernst & Young's strategy, according to Richard Welsh, national director for IS marketing.

Like Andersen & Co.'s Andersen Consulting subsidiary, Ernst & Young offers clients a range of services for both designing and implementing systems. Ernst & Young's new Navigator series of system design, implementation and project management tools is aimed at helping clients fully exploit today's CASE methodologies. Welsh says Navigator represents a major overhaul of the system design tools both firms were using prior to the merger to take advantage of newer information-engineering techniques, such as data modeling and error checking.

Ernst & Young has also established the Center for Information Technology Strategy in Boston to offer research and advisory services for users and vendors of information technology, a move that puts Ernst & Young in direct competition with such consulting firms as Gartner Group Inc. and the Index Group. The Advanced CASE Technology Center (ACTC) that Ernst & Young operates in Ann Arbor, Mich., is an outgrowth of the alliance that Arthur Young established in the mid-1980s with industry analyst James Martin and Atlanta-based KnowledgeWare Inc. *—Joe Kelly*

IS Revenues: $447.2 Million

REGION		WORLD
50	**MAXTOR**	81


Revenues By Region

MAXTOR CORP.
211 River Oaks Parkway
San Jose, CA 95134
(408)-432-1700

In the cutthroat competition of the disk drive market, Maxtor Corp.'s strategy has been to claim the high ground by maintaining industry leadership in drive capacity and speed. So far, the strategy seems to be working. The company's calendar 1989 revenues soared 32% to $447.2 million and net income rose 27% to $13.9 million.

The eight-year-old San Jose company has concentrated its efforts on high-performance drives for the workstation and server markets, while also offering drives for top-of-the-line personal computers. The company's latest products include, for example, a 340-megabyte 3½-inch drive and a 1.7-gigabyte 5¼-inch drive. Both set industry records for data storage capacity.

Maxtor is the undisputed leader in the market for these very high-capacity drives, according to industry analysts. Its 760MB 5¼-inch disk drive is without rival in the workstation segment.

"We will always push technical frontiers," says George Scalise, Maxtor's president and chief executive officer. To that end, Maxtor is also pioneering the market for erasable optical disks, which it first announced in 1988. Last year, Maxtor formed Maxoptix, a joint venture company with Kubota of Japan to manufacture and market its optical disk drives.

Like most of its competitors, Maxtor has shifted its high-volume manufacturing offshore. The company produces its most popular products in Malaysia and Singapore, while also maintaining some manufacturing operations in the United States.

In a surprise move that could significantly expand Maxtor's role in the disk drive industry, the company is acquiring Miniscribe Corp. of Longmont, Colo., for which it entered a successful $46 million bid in a bankruptcy court-ordered sale in April 1990. The transaction is expected to close on July 1st.

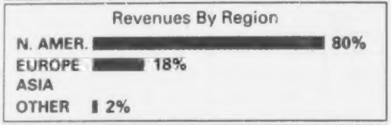
The acquisition will provide Maxtor with a new entrée into the low end of the disk drive market with Miniscribe's 1-inch high 3½-inch disk drive, expanding its potential market into the high-volume PC drive sector.

With the acquisition of Miniscribe, Maxtor has taken on a major challenge to rebuild, as its new subsidiary, a company that has suffered serious financial and management problems. As it enters the low-end 3½-inch disk drive market with Miniscribe's products, Maxtor will also find itself in the most brutally competitive sector of the disk drive industry, a sector it had previously avoided.

—Louise Kehoe

IS Revenues: $445 Million

REGION **51** **KODAK** WORLD **82**



EASTMAN KODAK CO.

343 State Street
Rochester, NY 14650
(716)-724-4000

Eastman Kodak Co. tried to energize its IS business in 1989 by reorganizing. "We began to realize at the end of 1988 that we were too fragmented," says Lawrence J. Matteson, a 25-year Kodak veteran who is head of the new Information and Imaging Systems Group overseeing IS businesses, including Kodak's effort in optical disks.

The creation of the Information and Imaging Systems Group was part of a companywide reorganization at Kodak—the fourth in five years. Kodak cut some 4,500 jobs in 1989 and took a $445 million charge that cut calendar 1989 earnings to $529 million, down 62% from the $1.4 billion earned in 1988. Sales rose by nearly 8% to $18.4 billion. As part of the restructuring, Kodak has sold some 20 businesses, including Verbatim Corp., which was the single biggest component of Kodak's IS business.

A casualty of the floppy disk price wars engulfing the industry in 1989, Verbatim was sold in April to chemical maker Mitsubishi Kasei Corp. In selling Verbatim, Kodak became the second U.S. firm to bail out of the magnetic media market. Last December, Indianapolis-based Anacomp Inc. sold its Xidex Corp. floppy disk business to Hanny Magnetics Ltd. of Hong Kong.

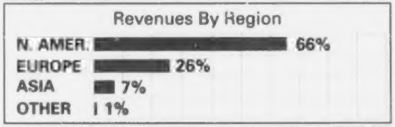
Prices for 3½-inch floppy disks fell as much as 60% in 1989. Although Verbatim had come out with innovations to keep sales and prices up, such as Teflon-coated disks, that wasn't enough for Kodak, which has been under pressure to boost earnings. Kodak is understood to have sold Verbatim for about $190 million. According to Santa Clara Consulting Group, Verbatim's 1989 revenues were just over $190 million, accounting for nearly half of Kodak's total IS revenues of $445 million. Kodak bought Verbatim in 1985 for $175 million. Kodak retains ownership of products codeveloped with Verbatim, such as the 5¼-inch erasable optical disk introduced last year. Kodak also offers a 14-inch optical disk system.

Verbatim was one of several IS acquisitions Kodak made in the 1980s. The others include Atex Inc. in electronic publishing, Eikonix Corp. in digital processing and, most recently, Interactive Systems Corp. in UNIX and Yourdon Inc., a consulting firm and software developer. The idea behind all of these acquisitions, like Kodak's 1988 purchase of Sterling Drug Inc., is to generate new revenue streams to counterbalance the slowing sales growth of its traditional photographic products.

Like Verbatim, Kodak's other acquisitions have struggled in the marketplace. Atex, although still one of the leading electronic-publishing systems, is battling the rise of PC-based desktop publishing and its own reliance on proprietary systems. It is now converting its systems to UNIX and introducing Macintosh-compatible products. *—Joe Kelly*

IS Revenues: $426.4 Million

REGION **52** **NOVELL** WORLD **84**



NOVELL INC.

122 East 1700 South
Provo, UT 84606
(800)-453-1267

During a year of growing competition and industry change, Novell Inc. navigated the local area networking waters with an admiral's skill. The company reported revenues of $429.2 million in calendar 1989, up a hefty 40% from the previous year. One reason for the increase was international sales, which by year's end accounted for 34% of revenues. Meanwhile, net income also grew at a healthy 52% clip to $52.6 million.

At the end of 1989, as at the beginning, industry analysts crowned Novell's NetWare network operating system the market leader, with market share estimates ranging from 52 to 70%.

Although the strong earnings were expected, Novell's financial performance seems particularly remarkable during a year when the company's primary product announcements were preparatory technologies, geared less toward 1989 revenue than anticipated future growth.

The announcement of Portable NetWare in January, for example, paved the way for traditional minicomputer companies to license the NetWare operating system code for development and sale in conjunction with proprietary networking schemes. Data General Corp., NCR Corp., Prime Computer Inc. and Wang Laboratories Inc. were among the most prominent companies to license Portable NetWare last year.

In May, Novell announced NetWare 386, the company's specialized server operating system for platforms based on the Intel Corp. 80386 microprocessor. Although widely praised by analysts for its speed and power, NetWare 386 wasn't actually shipped until September. Then, in June, Novell bolstered its management and development team with the acquisition of Excelan Inc., a supplier of Ethernet communications products for Apple Computer Inc. Macintosh systems and IBM PCs and compatibles.

"What we have announced at this point is a basic platform for systems development," says Kanwal Rekhi, the former president of Excelan, who now serves as executive vice president of product development for Novell. "We're preparing for the 1990s, for the next phase of network computing."

According to Rekhi, future extensions to NetWare 386 will include additional support for the Macintosh, for UNIX and for large computer network environments from vendors such as Digital Equipment Corp. and IBM.

Meanwhile, the company's flagship NetWare 286 operating system continued to dominate 1989 sales. Although Novell declined to provide a breakdown, Dataquest Inc., a market research firm based in San Jose, estimates that last year Novell sold some 180,000 copies of NetWare 286 and NetWare 386.

During the year, Novell continued its migration toward the software side of the networking scale. Following a pattern established several years ago, Novell further distanced itself from hardware sales by quietly dropping some of its PC Ethernet products in favor of increased emphasis on higher margin software products. By the end of the year, software accounted for 72% of net sales. For the year as a whole, 67% of sales were software related, as compared with 54% in 1988.

In the 1990s, Novell hopes to lead the transition from small work group networks to enterprisewide schemes incorporating a mix of mainframes, minicomputers and personal computers. Toward that objective, Novell announced this April its intention to merge with Lotus Development Corp. of Cambridge, Mass. Many analysts initially expressed doubt as to the synergy between spreadsheet king Lotus and local area network chieftain Novell. Now the industry may never know; talks between the companies collapsed at presstime. The marriage was to have been consummated this summer. The newly formed company would have had combined 1989 annual revenues of just under $1 billion, placing it on the same playing field as arch-rival Microsoft Corp., over in Redmond, Wash.

—Cheryl Snapp

IS Revenues: $426.4 Million

REGION		WORLD
53	MENTOR	85

Revenues By Region

N. AMER.	52%
EUROPE	27%
ASIA	19%
OTHER	2%

MENTOR GRAPHICS CORP.
8500 Southwest Creekside Place
Beaverton, OR 97005
(503)-626-7000

Mentor Graphics Corp., which is a newcomer to the lofty ranks of the DATAMATION 100, has not suffered from the financial hiccups common to so many high-tech companies. By the end of 1989, the company, located in the lumbering town of Beaverton, Ore., had logged 29 consecutive quarters of sales growth and 17 consecutive quarters of rising profits. That kind of mileage has solidified Mentor's position as the leading vendor of turnkey systems that aid in the design of chips, printed circuit boards and other electronics products.

That premier position was bolstered last year when Hewlett-Packard Co. acquired floundering Apollo Computer Inc., Mentor's main hardware supplier. Virtually all of the company's turnkey business is based upon Apollo workstations, which Mentor then integrates with software. In fact, until this year, Mentor's software only ran on Apollo's hardware. The HP takeover provides Mentor and its customers with reassurance that Apollo will be able to keep on supplying workstation wares.

Still, the pressure on Mentor to offer its products on more than just Apollo platforms continued building last year. Finally the company capitulated, announcing that it would port its software to the hardware of Sun Microsystems Inc. The move to Apollo's arch rival should help Mentor attract new customers since Sun workstations run UNIX and support open standards.

—Alden Hayashi

IS Revenues: $413.9 Million

REGION		WORLD
54	3COM	87

Revenues By Region

N. AMER.	60%
EUROPE	20%
ASIA	20%
OTHER	

3COM CORP.
3165 Kifer Road
Santa Clara, CA 95052
(408)-562-6400

According to Bill Krause, 3Com Corp.'s chairman and chief executive officer, 1989 was the year that 3Com underwent a "ritual of passage from a start-up to a major industry leader." Indeed, it was a roller coaster year for the networking and communications pioneer, which began its transition from being a low-end product supplier to a more services-oriented systems firm.

3Com began the year on an upbeat note after strong international and major account sales led to record high revenues and earnings. A flurry of multiprotocol product announcements and a development and investment deal with Hewlett-Packard Co. also raised hopes for a strong year.

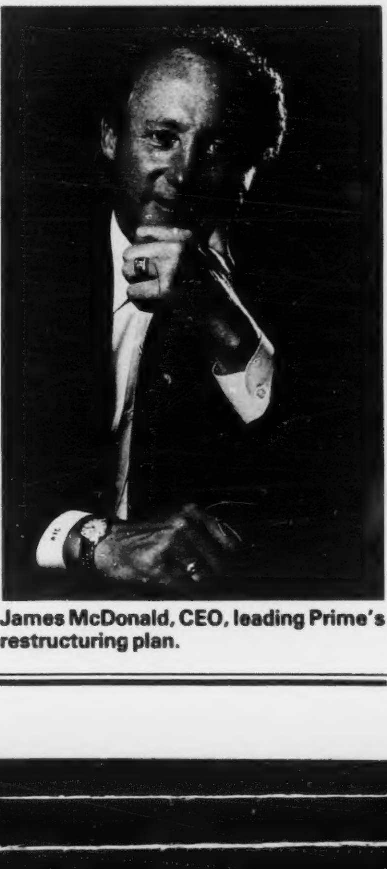
Then the tables turned. 3Com's heavy reliance on its Ethernet card sales, which had accounted for more than 60% of sales, became apparent after chief rival Novell Inc. dropped the prices of its cards. Afterward, 3Com's profits dragged to a new low. Disappointing sales of its highly touted 3+Open networking software for the OS/2 environment, a lack of product focus and an aggressive direct sales push that frightened resellers added to 3Com's woes. Wall Street reacted to disappointing fourth-quarter results. By the end of June, 3Com's stock had dropped by over $10 from its high of $27.65 per share, a third of its per share value.

In an attempt to rebound from its financial troubles, 3Com began a restructuring last September. It merged the Software Products Division with the Distributed Systems Division headed by 3Com founder and Ethernet inventor Robert Metcalfe, who is now vice president of marketing. The company also announced a new product strategy, which it hoped would refocus 3Com as a high-end product and services company.

By November, 3Com's picture brightened following the announcement of the 3S/500, a powerful network server, which impressed analysts and confirmed the company's move toward higher end systems. Unlike earlier marketing efforts for other 3Com products, which often divided the company into separate hardware and software camps, the 3S/500 was positioned as a single powerful system that would be cooperatively marketed by all.

Analysts expect a broad range of network management systems and tools from 3Com this year, including multivendor connectivity products and services.

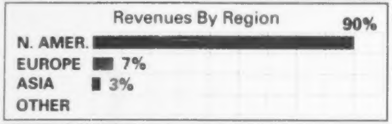
More changes are sure to follow. "We have a renewed focus on networking products," says Krause. "In the '90s, the essential ingredient will be the ability to manage the network." *—Tom Wood*



James McDonald, CEO, leading Prime's restructuring plan.

IS Revenues: $402 Million

REGION **55** | **EVEREX** | WORLD **88**



EVEREX SYSTEMS INC.
48431 Milmont Drive
Fremont, CA 94538
(415)-498-1111

Two years ago, Everex Systems Inc. was barely a blip on the then-booming PC sales screen, although its income from peripherals and enhancement products was more than respectable. Since then, growing sales from its own PC-compatible systems have pushed the company to a much more visible position. Currently, PCs account for over 55% of Everex's revenues, up from 29% in January 1988. Everex's calendar 1989 revenues were $402 million, up 22% from 1988; net income climbed to $21.3 million, up an even better 103%.

Unlike competitors that gained strength by increasing sales overseas or by tapping into the lucrative laptop market, Everex stuck to its knitting by selling bread-and-butter 80286- and 80386-based PCs to mostly domestic accounts. Of Everex's total sales, 90% are in North America. According to Alan H. Bushell, vice president of operations, much of the company's success can be tied to its telemarketing department, which maintains close ties with the Everex vendor network of 13,000 independent computer stores and national distributors such as Ingram-Micro D. The feedback gleaned from telemarketing is used in determining what products should be brought to market and when.

With executive offices located in the midst of the telemarketing department, direct customer feedback is assured. As a result, Everex claims that tight links between telemarketing and manufacturing help it to get products to market faster than its competitors.

In addition to full computer systems, the company's sales of peripherals and PC enhancement products continue to be strong, with IBM and Macintosh peripheral sales up 27% and 4%, respectively. Although total Macintosh peripheral sales accounted for a relatively small part of the revenue mix, company officials expect new products to revive the Macintosh business later this year.

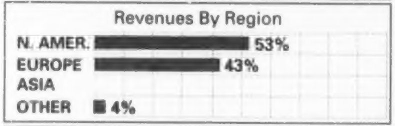
Everex introduced several new computers last year, including a number of 386-based models. Currently, says Bushell, PC sales are rapidly shifting to 386-based machines. Earlier this year, the company introduced a UNIX workstation based on Motorola Inc.'s 88000 reduced instruction set computing (RISC) chip and a PC based on Intel's 80486 chip.

According to Bushell, the company's expanding product line is no fluke. "We view ourselves as offering the connections between different operating environments," he says. "With our line of computers, peripherals and enhancement products, you can go from DOS to OS/2 or to UNIX with very little trouble."

Bushell cites a laser printer that Everex recently introduced as an example of his company's integration capabilities. The printer supports Hewlett-Packard Co.'s PLC printer protocol, as well as PostScript, thereby creating a single printing solution for customers with a mixture of PCs and Macs. "That kind of bridge building is what we're good at," he says. *—Bob Francis*

IS Revenues: $397 Million

REGION **56** | **MAI BASIC FOUR** | WORLD **90**



MAI BASIC FOUR INC.
14101 Myford Road
Tustin, CA 92680
(714)-731-5100

MAI Basic Four Inc. punctuated the end of the decade with a financial stroke that could only have been attempted in the financial freestyle of the 1980s. It tried to acquire a company many times its size and came very close to disaster as a result.

When declining sales of minicomputers, the company's bread and butter for 20 years, threatened its well-being, MAI reacted. The company first tried to sell itself. Failing that, it charged after $1.5 billion Prime Computer Inc., a Natick, Mass.-based minicomputer company, in a widely publicized battle that endured eight months.

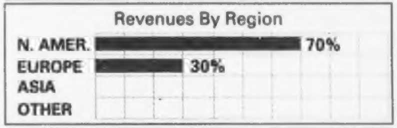
MAI lost the fight and much more. It was out millions of dollars, a president (Bill Patton) and its nice guy image. Securities analysts characterized MAI as in disarray and in a tailspin. Well, almost. MAI was suffering from declining sales—revenues dropped 10% to $397 million in calendar 1989. And it was losing money—net losses totaled $40 million for the 12-month period. But it was changing, too.

MAI stopped making hardware. It began a new life as a systems integrator, selling computers made by Japan's Acer America of San Jose, and Sequent Computer Systems Inc. of Beaverton, Ore. This new identity fully surfaced last December when MAI introduced its GPx series of systems. They offer what the company calls a dual universe—a combination of the UNIX operating system and MAI's long-standing Business Basic, or BOSS, operating system. One version in the series was a desktop GPx 340 model, the other a floor-standing GPx 440, acquired from Acer. Its larger model, the GPx 70 series, developed jointly with Sequent, was introduced early this spring.

MAI named a new president. Tapped was Fred Anderson Jr., a 12-year MAI veteran who most recently was its chief financial officer. Anderson succeeded William Weksel, who had replaced Patton and continues as the company's chief executive officer and chairman. As chairman, he succeeded Bennett S. LeBow, who became chairman of the board's executive committee. LeBow, who orchestrated the Prime bid, acquired MAI in a leveraged buy out in 1985. He heads Brooke Partners L.P., which has a 54% stake in MAI. *—Tom McCusker*

IS Revenues: $394.2 Million

REGION **57** | **QUANTUM** | WORLD **91**



QUANTUM CORP.
1804 McCarthy Boulevard
Milpitas, CA 95035
(408)-432-1100

Two years ago, Quantum Corp. bit the bullet. The personal computer hard disk drive manufacturer took a $17 million write-off and phased out its production of 5¼-inch hard disk drives to focus on the emerging market for 3½-inch drives.

At the time, most drive makers were anticipating a gradual shift toward the more compact drives. Yet Quantum was ahead of the pack in recognizing how quickly the transition would occur. The company's decision to put all of its energies into the new generation of disk drives enabled it to double its sales and assume a competitive lead in the industry. For calendar 1989, Quantum reported revenues of $394.2 million and net income of $41.3 million.

Quantum's 3½-inch ProDrive is used by Apple Computer Inc. in its Macintosh SE30 and Macintosh IIcx computers, as well as by Sun Microsystems Inc., which designed Quantum's 105-megabyte drives into its SPARCstation 1 workstations. Over the past year, the company has added several other computer companies to its customer roster, including Hewlett-Packard Co. and Next Inc.

Quantum focuses on the markets for high-performance personal computers and low-end workstations with drive capacities in the 40- to 210-megabyte range. The company is expected to expand its product line up to about 300MB this year, in line with industry trends. Quantum has also introduced 1-inch-high drives aimed at the laptop computer market.

Quantum's motto is "Do it once and do it right," says Stephen M. Berkley, chairman and chief executive. The disk drive manufacturer is obsessive about product quality and claims that its products have the highest mean time between failures of any in the industry. Still, Quantum's quality image took a dent last year when problems emerged with some of the drives it supplied to Apple. The problem was limited to some 2% of the drives shipped, Quantum says, and occurred only when the drives were used in extreme temperatures. Although quickly resolved, the episode came as a significant blow to the company.

Quantum's conservative, quality-oriented culture makes it a good match with its Japanese partner, Matsushita Kotobuki Electronics Industries (MKE), which manufactures Quantum's high-volume products, including its popular 40MB, 80MB and 100MB drives. Quantum builds higher capacity versions of its ProDrives at its own newly refurbished California plant.

The link with MKE was initially established by Quantum's subsidiary, Plus Development Corp., which, with its Hardcard product, pioneered the market for add-on hard disks mounted on circuit boards. These boards are typically used to upgrade floppy disk personal computers.

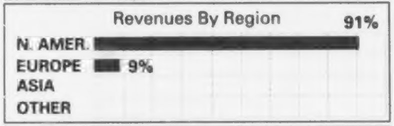
The add-on market and Plus Development's sales are now declining as personal computers are increasingly sold with hard disks already installed. One of the challenges Quantum faces this year is compensating for that trend.

Quantum is also facing stiff competition in the 3½-inch drive market. The company has a development program under way for a 2½-inch drive, which it plans to introduce this year. Quantum does not, however, anticipate a rapid switch to this new item.

—Louise Kehoe

IS Revenues: $390 Million

REGION		WORLD
58	SHARED MEDICAL	92



SHARED MEDICAL SYSTEMS CORP.
51 Valley Stream Parkway
Malvern, PA 19355
(215)-251-3164

Infected by the same malaise that has afflicted the health care industry, Shared Medical Systems Corp. has suffered through sluggish financial times of late. Taking the scalpel to some of its operations, the 20-year-old company cut costs and head count last year in an effort to improve its overall health. To stimulate revenue growth, SMS rolled out a series of new products in 1989, most notably the IBM-based Invision health care information system, introduced in September.

Despite lethargic financial performance, SMS is hardly a terminal case. The leading provider of health care information systems and software for two decades, SMS has stamina that should serve it well once the ailing health care industry snaps back and begins spending once again.

"They have cut their costs some and tightened things up. They've got things under control," says Stephen McClellan, first vice president at Merrill Lynch & Co. in New York City. "They've never had an unprofitable quarter, and they've always had terrific cash flow." On the downside, however, "they also don't seem to be moving aggressively into any new markets," says McClellan. "They're just not growing very much." Sales in 1989 rose just 3% to $390 million, while net income dropped 21% to $23.1 million.

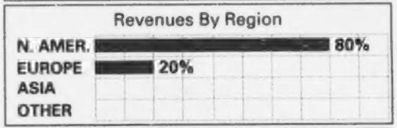
A good part of SMS' revenue continues to come from its traditional turnkey systems, which run on Digital Equipment Corp. VAX computers. At year's end, the firm won half a dozen hospitals over to its Allegra turnkey health care system.

The company has also added a new twist to its turnkey trade by instituting a version of time-sharing. Rather than sell a hospital a $1 million system, SMS now offers to set up the same turnkey system in its own data center and bill the customer on a basis similar to time-sharing. Merrill Lynch's McClellan says the company is getting a fair amount of that business, although it didn't affect last year's revenue very dramatically. "You won't see it in their numbers, because it's spread out over years," he explains.

But spreading business out for the long term is characteristic of Shared Medical's overall approach. Despite the health care industry's lack of vigor, "Shared Medical doesn't seem to be tempted to sell out or do an LBO," says McClellan. "They're sticking things out." *—Linda Runyan*

IS Revenues: $388.6 Million

REGION		WORLD
59	DELL	93



DELL COMPUTER CORP.
9505 Arboretum Boulevard
Austin, TX 78759
(512)-338-4400

In its first full year as a public company, Dell Computer Corp. found itself in some turbulent waters. Once a consistent performer, steadily releasing new products based on Intel Corp. chips, the company fell behind in introducing a personal computer based on the 33-megahertz version of the 80386 microprocessor.

One reason for the delay was Olympic,

an ambitious PC project that Dell hoped would land it in the front ranks of PC manufacturers. Instead, Olympic largely drained the company's manpower and its $17 million research and development budget. The result: the formerly fleet-footed Dell found itself somewhat far from the cutting edge in new products.

Olympic apparently was designed to separate Dell from the rest of the PC clone pack by incorporating proprietary circuit boards and chips using reduced instruction set computing (RISC) technology. After the project fell behind amid rising costs, the company finally scaled it back, although some research continues.

Management changes at the five-year-old firm also contributed to company woes, notably, the resignation of E. Lee Walker as president. Walker, considered a stabilizing factor, will remain on the company's board. But his move, made for health reasons, raised the specter of the company's early years of management thrashing. Walker's functions will be assumed by Andrew R. Harris, vice president of marketing, and Joel J. Kocker, president for U.S. sales and operations.

Despite the growing pains, Dell turned in a respectable year with good revenues, although income was down sharply partially due to the expensive Olympic project. For its 1989 fiscal year, which ended January 31, 1990, Dell reported revenues of $388.6 million and net income of $5.1 million, down from the $14.1 million level of the year before.

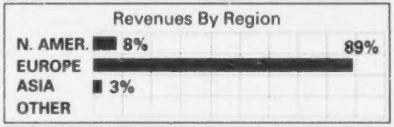
Michael S. Dell, chairman and chief executive officer, says sales growth can be attributed largely to rapidly expanding overseas markets, which accounted for 23% of the company's sales during its fiscal year, up from 15% the prior year. Dell launched its overseas division in June 1987 and now operates subsidiaries in Britain, France and West Germany.

Another factor fueling the company's growth, says Dell, is a shift toward large accounts with *Fortune* 500 companies. Where once Dell relied almost exclusively on its telemarketing group to sell individual PCs by mail order, corporate accounts now constitute 40% of sales. "We've had good penetration in getting on the short list of corporate accounts," says Dell. Part of the reason for the change is that many big companies are buying PCs in large quantities, and Dell has made inroads by catering to the needs of corporate support personnel.

As was true of most PC firms last year, revenues at Dell shifted rapidly from 286-based PCs to 386-based machines. Dell's high-powered 386 machines now constitute 47% of revenue, up from 26% in 1989. Products introduced last year include a long-awaited 80386SX-based machine, which shipped in November. The company's first laptop product, also based on the 386SX chip, also appeared in November. This March, the company released a 20MHz version of the 386SX computer and a 486-based PC using the Extended Industry Standard Architecture (EISA) standard. At the same time, the company introduced the Dell Station, a UNIX/DOS workstation configured with UNIX office automation software from Irving, Texas-based Uniplex Integration Systems Inc. *—Bob Francis*

IS Revenues: $377.9 Million

REGION **60** **TANDON** WORLD **96**



TANDON CORP.
405 Science Drive
Moorpark, CA 93021
(805)-523-0340

It's not stretching things to say that the history of personal computing would have been a lot different without Tandon Corp. Tandon was a manufacturer of disk drive components in the late 1970s when the first PCs began to appear. Founder Sirjang Lal (Jugi) Tandon sensed an opportunity and plunged in as a manufacturer of 5¼-inch drives. Sales went from $3 million in 1977 to $300 million in 1983. The company got so cocky, it ran an advertisement saying it no longer competed in disk drives because "you can't compete when you've got no competitor."

But plenty of competitors appeared, Tandon misread the market for hard disk drives and, by 1985, the company was running an annual loss of $135 million.

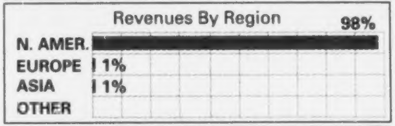
Now it's back again, but this time around, Tandon isn't making disk drives, it's producing the whole computer. And by concentrating on sales in Western Europe—it drew some 89% of its revenues from Europe in 1989—the company has emerged as a real PC success story. Last year, sales rose 22% to $377 million. Although it still lost $4.3 million, that's better than the $20 million loss in 1988. For the last half of the year, Tandon was running well in the black. And, in the first quarter of this year, Tandon reported a healthy 13% increase in revenues to $105 million and continued profitability of $7 million.

Tandon's success has been based more on marketing than technology. Its distribution network assembled by Chuck Peddle, a pioneer in PCs, is considered to be one of the best in the business. But lately Tandon has also been polishing its image as an innovator. At the end of the year, it began shipments of its new Tandon 486 PC, sporting a removable optical disk drive.

Tandon's strong European distribution network makes it a likely takeover candidate for any company—European, Japanese or U.S.—that wants to bolster its market presence in PCs in anticipation of the lowering of trade barriers in Europe in 1993. Rumors abound that Sirjang Tandon would be more than happy to unload his company if the price is right. *—Joe Kelly*

IS Revenues: $359.2 Million

REGION **61** **BOEING** WORLD **98**



BOEING COMPUTER SERVICES
2800 160th Avenue, S.E.
Bellevue, WA 98008
(206)-655-1131

Although Boeing Computer Services is one of the smallest divisions of $22 billion parent corporation The Boeing Co., it had a respectable $1.5 billion business base in 1989. The division's primary role is providing computer and telecommunications support for Boeing's own operations, with an emphasis on sister divisions that cater to commercial airplanes, defense and space. Boeing Computer Services also markets its systems integration experience to government and commercial clients.

In calendar year 1989, the division produced $359 million in external sales, a 31% increase over the $274 million in outside revenues posted the previous year. Government contracts continued to account for the vast majority of the division's external business. Commercial contracts, in contrast, garnered $52 million of the $359 million sum.

Boeing Computer Services is a major subcontractor to AT&T on the FTS2000 program, a $4.5 billion Federal Telecommunications System contract signed in late 1988. The program is designed to establish and service an automated information system for use by 1.3 million federal government employees. And last year, the division captured a $105 million contract to provide information services to the Naval Weapons Center in China Lake, Calif.

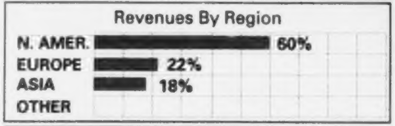
Boeing Computer Services provides data-processing services to the National Aeronautics and Space Administration's (NASA) solid rocket booster assembly and refurbishment program and, is developing an automated information system for the space station *Freedom*.

Boeing Computer Services made headlines this March when division President Mike R. Hallman departed to serve as president and chief operating officer for Microsoft Corp. The new head of the division, Art Hitsman, is a 40-year Boeing veteran who began his Boeing career in aircraft design. —*Cheryl Snapp*

IS Revenues: $344.6 Million

REGION
62
CONCURRENT
WORLD
100

Revenues By Region



CONCURRENT COMPUTER CORP.
106 Apple Street
Tinton Falls, NJ 07724
(201)-758-7000

Concurrent Computer Corp. finished its merger with Massachusetts Computer Corp. (Masscomp) in 1989 and also overhauled its line of real-time superminicomputers. Of course, that's a tall order for one year, so it's no surprise that Concurrent's sales went on automatic pilot at $344.6 million, up marginally over the 1988 pro forma results DATAMATION reported last year. The company also reported losses of $13.3 million for 1989.

Concurrent pioneered the real-time supermini in the mid-1970s when it was the data systems division of Perkin-Elmer Corp. A substantially upgraded version of the OS/32 operating system it developed back then is still the basis of its 3200 line of proprietary systems. Concurrent's main customers are technical users, but it also is going after the faster growing commercial real-time market.

Last year, the company combined three factories into two and also reoriented its production to take advantage of more third-party specialists in areas like board manufacturing and surface mount assembly. "We tried to do it in 90 days and ran into lots of problems," says James K. Sims, Concurrent's president and chief executive officer. "We should have planned an extra 90 days."

In January, Concurrent slimmed down, cutting some 240 employees (about 7% of its work force), a move that is expected to save some $12 million a year. Because it carries a heavy debt load of some $200 million, primarily from the Masscomp merger, Concurrent can't afford any excess fat.

Concurrent extended its proprietary systems with its new MicroThree and MicroFive series. On the UNIX side, it introduced its first reduced instruction set computing (RISC) system early this year, the series 8000. It also came out with RT-NET, a series of connectivity products that will enable customers to link Concurrent's systems with those of Digital Equipment Corp. and Sun Microsystems Inc.

Concurrent's sales mix is still heavy on the proprietary side. According to Sims, the changeover to more open systems sales depends on how fast Concurrent can get UNIX to deliver real-time performance. "We're getting UNIX under a 500-microsecond response time, but it is still not the performance you will get from proprietary systems. It's going to be one or two more generations before we get that." —*Joe Kelly*

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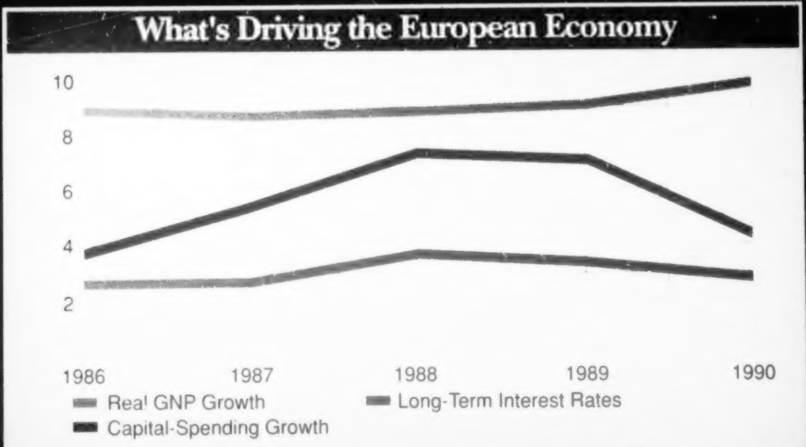
Circle 36 on Reader Card

Breaking barriers in Eastern Europe will truly mean a single common market.

Groupe Bull's Lorentz agressively seeks opportunities on the European frontier.



Sources: International Monetary Fund and World Economic Outlook

THE DATAMATION 100

As Western Europe reshapes itself into a common market, will Bull, Olivetti and Siemens be strong enough to keep U.S. and Japanese suppliers from capturing any more of the market?

European Unity Creates New Superpowers

"The [European] Community shall adopt measures with the aim of progressively establishing the internal market over a period expiring on 31 December 1992. . . . The internal market shall comprise an area without internal frontiers in which the free movement of goods, persons, services and capital is ensured in accordance with the provisions of this Treaty."

Those words, from the treaty establishing the European Economic Community, signal the creation of the world's largest market for information technology. On January 1, 1993, the 12 member nations of the European Community will create what is often called the United States of Europe. Under EEC rules, trade barriers between nations will be as lax as barriers

BY CATHERINE BARNAT

British Telecom networks worldwide.

between New York and Connecticut. This internal market will be the largest integrated economic area in the world, with more than 320 million consumers and a gross domestic product of some $5 trillion.

Moreover, the EEC sees information technology as an integral part of a United Europe. The Single European Act that decreed the establishment of an internal market also designated the creation of a "European technological community" as one of the goals of Community policy.

But the community may find it has less and less control over the definition of *Europe* in the 1990s. The dramatic events of the past year in Eastern Europe, such as the impending reunification of Germany, have made the Continent a much larger economic force to be reckoned with. The relaxation of trade restrictions with the East Bloc, particularly on technology, leaves forecasters with a question mark for the future of the entire continent.

The only certainty here is that demand for information technology will grow; by how much is anyone's guess. Most market forecasts do assume that growth in sales of computer, telecommunications and office automation equipment in Europe will outpace that of the United States, just as it has over the past two years.

Europe already accounts for 30% of the world's spending on information technology, second only to the United States (40%) and well ahead of Japan (15%), according to the EEC. While demand in the United States has been sluggish at best in the last two years, Europe's thirst for computer equipment has continued to surge. In fact, several U.S. computer suppliers have been more than candid in admitting that their European sales were the only factor that kept them in the black last year.

The European Elite

European companies with the best IS revenues for 1989

EUROPEAN RANK	WORLD RANK	COMPANY	IS REVENUES ($ MILLIONS)
1	8	Groupe Bull	6,465.4
2	9	Siemens	6,010.6
3	10	Olivetti	5,573.3
4	18	NV Philips	2,814.8
5	19	Nixdorf	2,792.6
6	22	STC	2,643.4
7	28	Memorex	2,056.6
8	32	Alcatel	1,800.3
9	46	Nokia	1,191.9
10	48	Cap Gemini	1,103.4
11	54	Mannesmann	819.1
12	59	Amstrad	717.0
13	62	British Telecom	692.5
14	64	Finsiel	662.5
15	68	Racal	573.9
16	69	Comparex	566.0
17	83	SD-Scicon	431.5
18	89	Sligos	400.7
19	95	Sema Group	378.6
20	99	Norsk Data	358.1
21	109	Logica	314.0
22	114	Software AG	294.0
23	118	GSI	277.1

There are some indications that European demand may slow this year. Reasons for the slowdown include some sluggishness in major economies such as Britain and France, as well as a rise in interest rates. But suppliers are still certain that European demand for computers will outpace that of the United States. Vittorio Cassoni, managing director of Italy's Ing. C. Olivetti & Co., even predicts that computer buying in Europe will not follow the U.S. pattern of steep peaks and valleys in orders.

The Single-Market Bonanza

The freeing up of trade restrictions is the driving force behind Europe's demand for information technology. An EEC-commissioned study known as the Cecchini Report estimates that the total economic benefit of the 1993 changes will be around $200 billion, leading to the creation of some 2 million new jobs.

Banks, accounting firms and other financial services companies are expected to be the first European industries to attempt to cash in on the potential economic bonanza promised by the single market. Once strictly national institutions are already opening branch offices throughout Europe, adding personnel and updating operations so that they can more effectively compete on an international scale.

Manufacturers, also aware that they must expand beyond national boundaries in order to compete, are investing in new plants and offices. All this expansion is universally assumed to translate into more computer purchases, software upgrades and data communications improvements.

"The technological preparations for the common internal market have unmistakably begun," says Francois Salle, president of the European Association of Manufacturers of Business Machines and Information Technology (Eurobit). "Investments involve future-oriented business decisions based on long-term perspectives, so it is only too understandable that investments in plant come out on top in the forecasts of economic expansion."

The problem for European information technology suppliers, however, is how to get a larger piece of that investment. The EEC estimates that European suppliers only account for 24% of the world's computer production. That is not enough to keep them in the black. The British Computer Society even predicts that the EEC's trade deficit in information technology will increase from $12 billion dollars in 1989 to $17 billion by 1995.

What's driving the deficit upward is that more European users are buying U.S.- or Japanese-made information systems than European suppliers are able to export. Although most European countries do support a so-called national champion—a native supplier that sells lots of computers at home and virtually none across the border—that is hardly enough to compensate for the amount of business IBM and other foreign suppliers do in the region.

Siemens AG of West Germany, the largest infor-

Big Exporters in Europe

The European companies with the most IS sales outside their home markets

	1989 RANK	COMPANY	IS REVENUES N. AMER.	EUROPE	ASIA	OTHER
1	8	Groupe Bull	1,939.6	4,073.2	0.0	452.6
2	28	Memorex	1,069.4	678.7	287.9	20.6
3	10	Olivetti	501.6	4,514.4	390.1	167.2
4	18	NV Philips	591.1	2,054.8	168.9	0.0
5	9	Siemens	541.0	5,409.6	60.1	0.0
6	62	British Telecom	484.8	138.5	34.6	34.6
7	22	STC	264.3	2,167.6	105.7	105.7
8	32	Alcatel	108.0	1,476.2	0.0	216.0
9	68	Racal	229.6	258.3	57.4	28.7
10	48	Cap Gemini	209.7	893.8	0.0	0.0

Revenue figures are in millions of dollars.

mation technology supplier headquartered in Europe, is a classic national champion. About 70% of the $3.2 billion in revenue generated last year by its Data and Information Systems Division came from within West Germany. Another 2% came from the rest of Europe. U.S.-owned IBM, on the other hand, produced nearly 35% of its $62.7 billion in 1989 revenue by selling systems in Europe. Such size makes IBM the biggest information technology supplier in every European country in which it does business.

Europe's native information technology suppliers are even further behind when it comes to innovation. Although the region's computer scientists are considered among the best in the world, there have been no significant commercial breakthroughs in computers from Europe. Europe cannot boast of a homegrown Apple Computer Inc.

"The U.S. leads in computers, software and services and in some areas of industrial automation," Eurobit stated in a briefing paper for the EEC. "Japan leads in components, consumer electronics and some office products, while Europe is third except in telecommunications and software and services."

Grow or Be Gone

European suppliers don't have many choices these days. Broad-based suppliers intent on surviving through the 1990s must merge, cooperate and pay attention to opportunities in Eastern Europe. If they don't, they're likely to be out of the information systems business. Niche suppliers must focus on creating value in software and services.

Groupe Bull SA of France, for example, has turned itself into one of the world's leading suppliers of personal computers by acquiring Zenith Data Systems Corp. The acquisition, which took place last year, is part of a grand strategy by Bull. The key to the company's growth, says company chairman Francis Lorenz, is increasing its reach into the European market before the changes of 1993 go into effect. Two-thirds of Bull's revenues already come from outside France.

Another champion, Siemens, decided to increase its clout by acquiring its largest West German competitor, Nixdorf Computer AG. The merger creates an enterprise that in 1988 generated $9 billion in information systems revenues.

More mergers among European information technology suppliers are expected during the next five years. Some analysts speculate that only three large European groups will exist in 1995—Siemens, Bull and an Olivetti combination. Few expect Finland's Oy Nokia, Norway's Norsk Data AS, Great Britain's Amstrad PLC and the Netherlands' NV Philips' GL to still be independent. Olivetti has already announced that it is holding talks on possible cooperation with NV Philips as part of "a stage of diffused negotiations with a number of European companies for other possibilities of collaboration." Britain's STC has spent the past year looking for a foreign partner for its International Computers Ltd. (ICL) subsidiary.

Joint research ventures also are popular in Europe. They give suppliers the collective clout to back the kinds of massive research projects that individual companies in the United States and Japan can fund on their own. The EEC is a big proponent of such joint ventures, allocating nearly half of its research budget for information technology projects. Two of its better known efforts are the European Strategic Program for Research in Information Technologies (ESPRIT), which covers basic research and development in information technology, and RACE, for work aimed at integrated, broadband communication.

But, to date, only one commercial product has evolved from any of these ventures—the transputer

Where Europe Excels

European companies with the highest software sales

	1989 RANK	COMPANY	SOFTWARE REV.	IS REV.
1	9	Siemens	638.3	6,010.6
2	8	Groupe Bull	517.2	6,465.4
3	10	Olivetti	497.7	5,573.3
4	64	Finsiel	391.5	662.5
5	95	Sema Group	378.6	378.6

European companies with the highest datacom sales

	1989 RANK	COMPANY	DATACOM REV.	IS REV.
1	9	Siemens	1,345.7	6,010.6
2	32	Alcatel	756.4	1,800.3
3	68	Racal	573.9	573.9
4	18	NV Philips	457.4	2,814.8
5	62	British Telecom	332.4	692.5

Revenue figures are in millions of dollars.

microchip, manufactured by Inmos of Britain. The transputer, introduced five years ago, offers twice the speed of Intel Corp.'s 80386, has four communications channels and, for under $10,000, can be configured into a desktop computer, giving it more power than a Digital VAX 8000 minicomputer. Unfortunately, a lack of software stunted the transputer microchip's growth, and now Intel's i860 superchip can outperform it.

So, bigger companies and bigger research budgets may not necessarily translate into bigger market share for the European players. "The ability to sell in foreign markets depends very much on the resources you have—the ability to recruit staff," says Jerry Sanders, an independent computer consultant in London. The biggest beneficiaries of a single common market in Europe, he believes, will be suppliers that are farthest away from Europe, have been established for 10 years or more and already know how to trade in several markets—in other words, U.S. companies. "The irony is that, of course, in America they've never really distinguished between individual countries. Americans have been thinking about Europe as a single market for a long time," he says.

Software and Services Shine

All is not gloom and doom for native European suppliers. They do enjoy an advantage in one critical arena: software and services. U.S.-based suppliers have little presence in the $20 billion European software and services market, which is expected to grow 20% by 1992. By then, European users will be spending 60% of their information technology dollars on software and only 40% on hardware, predicts Merrill Lynch & Co. Analysts at the New York City brokerage firm say the ratio today stands at 40% software, 60% hardware.

The largest independent software and services company in Europe now is Cap Gemini Sogeti of France. But its $1.1 billion in revenues still represent only 5% of the total European market, leaving plenty of room for growth by other EEC native suppliers.

The Ups and Downs in Europe

The companies that grew the most in 1989

	1989 RANK	COMPANY	1989 IS REVENUE	1988 IS REVENUE	% INCREASE
1	8	Groupe Bull*	6,465.4	5,296.7	22.1%
2	64	Finsiel	662.5	545.4	21.5%

The companies that couldn't keep up in 1989

	1989 RANK	COMPANY	1989 IS REVENUE	1988 IS REVENUE	% DECREASE
1	99	Norsk Data	358.1	450.2	(20.5)%
2	59	Amstrad	717.0	841.8	(14.8)%
3	19	Nixdorf	2,792.6	3,044.9	(8.3)%
4	69	Comparex	566.0	614.5	(7.9)%
5	28	Memorex	2,056.6	2,078.5	(1.1)%

* Growth partly due to merger or major acquisition
Revenue figures are in millions of dollars.

Companies that call Brussels, Milan, Paris and other Continental sites home also have something else going for them in software: UNIX. Europeans have embraced the AT&T operating system and just about every other open systems standard as a way of avoiding dominance by U.S. suppliers. Thus far, U.S. suppliers have mostly sold proprietary systems to European users.

San Jose-based market research firm Dataquest Inc. predicts UNIX-related sales of software and systems will account for 20% of all information technology spending in Europe by 1992—up from 10% today. "The UNIX growth rate within each [category of computer] is greater than the overall segment growth rate," observes Jane Doorly, a Dataquest analyst.

But UNIX carries its own price—one that shows on the bottom lines of companies selling UNIX-based systems. Because anyone can license the standard from AT&T, UNIX spawns competitive pricing. Because it's new, UNIX requires suppliers to invest huge sums of money in software development and on features that help their UNIX solutions stand out in the marketplace.

Bull expects profit margins on systems to drop as much as 15% as customers move to UNIX. "We are committed to standards, and that doesn't make an easy situation," says Didier Ruffat, president of Bull's international operations. His company, for example, sold 39% more UNIX-based systems in 1989 than in 1988 in West Germany, but revenues from those sales increased only 21%. "I don't expect a high growth rate [in revenues] for the next few years," Ruffat says.

What Hand Will the East Bloc Deal?

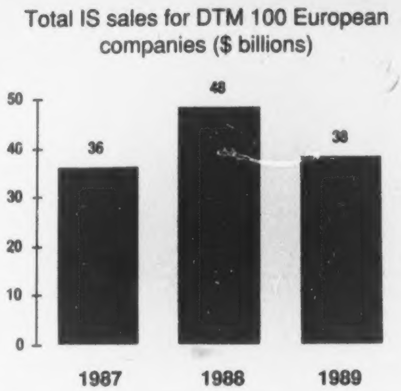
The wildest wildcard in Europe isn't UNIX, however; it's Eastern Europe. The advent of democracy in the East Bloc has sent the EEC scrambling for a proper response, and that response is to treat the largest new market in the world as a trading partner like any other. The East Bloc is expected to have a tremendous appetite for information technology as it hastens to establish a market economy and catch up with the West in everything from factory automation to telephone service.

"There is a great need for modernization of the infrastructure in these countries, and at the heart of this modernization is information technology," says Cliff Clarke, international trade policy manager for Digital. The world's No. 2 computer maker has just invested $2 million on a joint venture to sell computers in Hungary, with the realistic expectation that it may not pay dividends for some time. Most experts are of the belief that it will be five to 10 years before such ventures could hope to turn a profit. "We see enormous potential demand," Clarke explains, "and we are positioning ourselves for it now."

Information technology already gets some credit for the revolution in Eastern Europe. "Technology has made it possible," says U.S. Commerce Secretary Robert Mosbacher. "[Communist regimes] were transcended by people power, based by telefax and videotape."

Now the people of these nations want to get their hands on as much technology as they can. Eastern Europe is expected to spend $30 billion dollars on telecommunications equipment by the year 2000—not far below the United States. And that estimate may be conservative. West German Post Minister Chritian Schwarz-Schilling says $40 billion to $60 billion must be invested in East Germany's telecommunications system, with its 25- to 60-year-old public switches, to bring it up to West German standards. "This will remain the most serious problem for the next two years" in merging the two Germanys, he says.

Europe Holds its Own



The Soviet Union also has ambitious plans for its antiquated telecommunications system. Moscow officials want to increase the number of telephones in the country from 40 million today to 100 million by 2005. At the same time, they want to immerse Soviet society in computers—part of an ambitious program called "informatization."

The Soviets currently have 200,000 personal computers—one for every 1,500 citizens in a country whose population is 300 million people. The United States has about 38 million PCs—one for every seven of its 260 million people.

Most analysts see the East Bloc turning to Western European suppliers—not U.S. or Japanese companies—to help meet its computer needs. The reasons are many: partly because of proximity; partly because of the existing relationship between the regions; partly because U.S. companies are more reluctant to commit themselves to the long-term investments required of such trade; partly because of the problems of currency translation—but mostly because of CoCom.

Will Trade Restrictions Ease?

For 30 years, The Coordinating Committee for Multilateral Export Controls (CoCom)—whose members include the major economic powers except Japan and Australia—has been setting restrictions on technology exports to the East Bloc in order to prevent military equipment from reaching the Soviets. The end of the Cold War has brought calls for the end of technology restrictions from virtually all members of CoCom—except the United States. Although Washington is expected to agree to relax trade restrictions with Czechoslovakia, East Germany, Hungary, Poland and Romania, U.S. officials clearly state that the Soviet Union will still be off limits, to a large degree. "We are not going to turn around and just give the Soviet military the opportunity to catch up with us," Mosbacher says.

The United States' hard-line attitude is forcing U.S. information technology suppliers to move slowly with regard to the East Bloc, giving Western European rivals a chance to capitalize on an already existing trade advantage. The East Bloc could overtake North America as the EEC's largest export market by the year 2000.

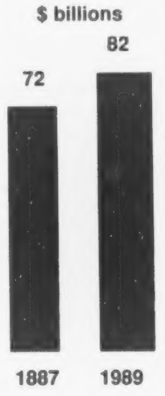
The East Bloc has a precious information technology resource to trade of its own—expertise in software development. Soviet and other East Bloc programmers are generally recognized as excellent, despite having to work with ancient technology tools. Witness the sophistication and success of Tetris, currently one of the best-selling computer games in the United States. Designed by Soviet programmer Alexey Pazhitnov, it's the first Russian computer game to enter the U.S. market. Russian-designed PC software packages include a time planner/project management program, a macroeconomics modeler, a database for TV schedules and a word-processing program similar to WordStar that includes a Russian-language thesaurus.

In addition to Digital's ventures in Hungary, there is some interest, albeit cautious, from U.S. information technology suppliers and retailers in the East Bloc. Computerland Corp. just opened the first computer store in Moscow, and various companies are setting up joint ventures to market products in the region. "We will be selling there in a significant way in a matter of years," promises Dean Morton, chief operating officer of Hewlett-Packard Co. He boasts that his Palo Alto company has had an office in the Soviet Union since 1969; the office now has 65 HP employees.

Trade experts are convinced this activity will increase, particularly because, as borders become free, trade barriers will become meaningless. "It's becoming very difficult to police CoCom," says Ambassador Bradley Holmes, director of the U.S. State Department's Bureau of International Communications and Information Policy. "But I'm sure you will continue to see substantial relaxation [of CoCom rules]. As technology changes, the process of review will change as well."

Change, indeed, is the watchword for users and suppliers of information technology in Europe. Trade and political barriers are disappearing. Native suppliers are consolidating. Technologies are shifting. Whether Europe's high and mighty—Bull, Cap Gemini, Olivetti, Siemens—can change fast enough with the times to keep their U.S. and Japanese competitors in check is a question that will be answered in the next few years. ▭

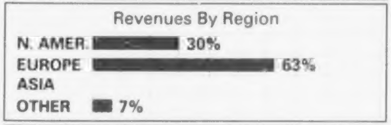
Catherine Barnat is a freelance writer based in London.



Europe spent $82 billion on IS in 1989, up 14% from 1987.

IS Revenues: $6.47 Billion

REGION 1 · **GROUPE BULL** · WORLD 8



GROUPE BULL SpA

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Thanks to its takeover of Zenith Data Systems Corp. (ZDS), Groupe Bull SpA took another step toward greatness in 1989, overtaking Ing. C. Olivetti & Co. to become Europe's second largest computer company. But Bull also took a step backward into the red after four years of modest profits.

The acquisition of ZDS boosts Bull's revenues by some Fr8.5 billion ($1.3 billion), giving the company total revenues (on a projected, pro forma basis) of Fr41.3 billion ($6.5 billion) at the start of 1990. However, not taking ZDS into account, Bull's revenues increased by only a meager 4% to Fr32.7 billion ($5.1 billion). After posting net earnings of Fr303 million ($51 million) in 1988, the firm lost Fr267 million ($41.8 million) in 1989.

That figure accounts for Fr405 million ($63.5 million) in restructuring costs associated with plans to shrink Bull's French work force by 1,200 in 1990 from the present total of 18,500. Some 1,800 jobs were shed in France from 1988 to 1989, with an earlier 3,200 positions eliminated in the United States from 1987 to 1988.

Aside from adding revenues, the ZDS takeover has improved the distribution of Bull's revenue base. Bull has merged all its microcomputer activities with ZDS, and the enlarged company now generates 30% of its revenues in the United States (compared with a pretakeover 16%). Bull paid an agreed purchase price of almost $500 million for ZDS, but a subsequent reduction in estimates of the company's net worth led it to reclaim some $50 million from Zenith Electronics Corp., ZDS' parent company.

The capital of Compagnie des Machines Bull (CMB), Groupe Bull's parent company, was increased by a further Fr965 million ($151.3 million) in 1989, most of it contributed by the French government. The capital of Bull's U.S. subsidiary, Bull HN Information Systems Inc., was raised by $100 million, which was contributed by CMB and NEC Corp.

Bull's commitment to UNIX was rewarded early in 1989, when it became the first vendor to be certified by the X/Open Group for its SPIX operating system and DPX 2000 range of systems. Along with announcing new models and functionalities for its DPX 2000 series, Bull introduced a new UNIX system, the DPX/2, and the DPS 6000 series of departmental systems running both UNIX and GCOS 6. And Bull licensed Sunnyvale, Calif.-based MIPS Computer Systems Inc.'s reduced instruction set computing (RISC) technology for its high-end UNIX systems.

Bull also picked up some valuable contracts for its mainframes in 1989. Elf-Aquitaine in France added a second DPS 90 to its Grenoble site; the Michigan Department of Social Services ordered one DPS 90 system worth $20 million; and General Electric Co. signed a $53 million deal for five DPS 90s, nine DPS 9000s and five DPS 8000s.

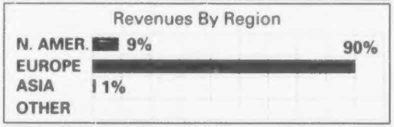
Whether Bull sustains greatness in the market depends on former managing director Francis Lorentz, now chairman and chief executive officer of the firm. He replaces Jacques Stern, the great architect of Bull's return from the brink of disaster between 1982 and 1989, who left in June 1989 to launch a supercomputer venture.

—James Etheridge

Groupe Bull's CEO Francis Lorentz talks strategy with Zenith's John Frank.

IS Revenues: $6.01 Billion

REGION 2 · **SIEMENS** · WORLD 9



SIEMENS AG

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(49-89)-234-0000

Siemens AG shook up the industry in 1989 with its decision to snap up long-term local rival Nixdorf Computer AG. The acquisition was announced on the heels of a difficult year for Nixdorf, which reported a shart downturn in revenue growth, compounded by heavy losses in orders. The merger, however, will not be formally completed until this fall.

The new Siemens-Nixdorf Informationssysteme AG concern will have DM16.6 billion ($8.8 billion) in IS revenues. With 51% ownership, Siemens will gain the foothold it needs to build up its market presence throughout Europe—especially in France, Spain and the United Kingdom. By acquiring Nixdorf's customer base, Siemens will gain more retailers and banks. Nixdorf, in turn, may benefit from Siemens' strengths in computer-aided design and manufacturing (CAD/CAM), not to mention its financial reserves.

Siemens reported total revenues for 1989 of DM61.1 billion ($32.5 billion). The Communications and Information Systems division, which consists of three groups—Data and Information Systems, Private Communications Systems and Peripherals and Terminals—reported moderate growth of about 3% due in part to the success of Siemens' newly expanded BS2000 product line.

In telecommunications, Siemens struck out into new territory by purchasing Santa Clara-based Rolm Systems from IBM. Rolm Systems handles manufacturing and development, while a joint venture between Siemens and IBM, ROLM Co. of Norwalk, Conn., handles sales and services.

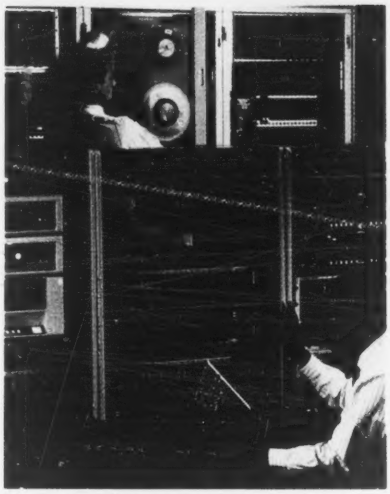
Several factors caused Nixdorf's weak performance in 1989. Publicly, Nixdorf's chief executive, Horst Nasko, blames negative press for the company's drop in revenues to DM5.25 billion ($2.8 billion) and its 15% decline in orders. Privately, he says decentralized planning was the cause of the shortfall. Nasko, who has been head of the company since Klaus Luft resigned in November, also acknowledges that Nixdorf's overdue switch from its proprietary systems to standard solutions took "an appreciable toll in terms of time and expense."

Despite the firm's difficulties, Nixdorf's telecommunications business flourished last year. Revenues in that sector increased some 35% to DM250 million ($132 million) in 1989. Nixdorf also celebrated the success of its Integrated Services Digital Network (ISDN)-capable terminals. And the company made a massive effort to underline its competence as a systems integrator for its traditional customer base. Nixdorf upgraded its UNIX-based Targon computers as well as introducing several new applications, PCs made to run on MS-DOS and UNIX and a new line of self-service equipment.

Siemens-Nixdorf will also implement a program set up at the end of 1989 by Nixdorf—independent of the merger—to significantly improve profitability in 1990. The plan includes reducing unprofitable activities such as CAD/CAM, decreasing personnel and increasing the firm's concentration on software and services.

While Nixdorf merely planned a restructure in 1989, Siemens transformed its overgrown bureaucracies into 15 lean business units. Siemens' chief executive Karlheinz Kaske says these units give the company "new flexibility to react quickly to rash changes in the industry as well as the trend toward global markets." The reorganization apparently enabled the company to launch an aggressive joint acquisition with London's General Electric Co. of U.K. defense contractor Plessey Co. PLC. The maneuver will give Siemens control of Plessey's communications divisions in a joint venture known as GEC Plessey Telecommunications Holdings Ltd.

—*Peggy Trautman*



Siemens takes an aggressive stand on the information systems industry.

IS Revenues: $5.57 Billion

REGION		WORLD
3	OLIVETTI	10

Revenues By Region

N. AMER.	9%
EUROPE	81%
ASIA	7%
OTHER	3%

ING. C. OLIVETTI & CO. SPA
Via G. Jervis, 77
10015 Ivrea, Italy
(39-125)-525

After two years of diminishing profits, Olivetti suffered another sharp drop in earnings in the 1989 calendar year: profits plunged 43% to L202.8 billion ($147.8 million). The problem wasn't sales. Total group revenues rose 7.4% to L9.03 trillion ($6.6 billion), while IS revenues in particular advanced by 8.2% to L7.65 trillion ($5.6 billion).

A dismal showing in 1988, when profits were down 11.4%, led the group to undertake a major 1989 restructuring. It reorganized into four divisions—Olivetti Systems and Networks, Olivetti Office, Olivetti Information Services and Olivetti Technologies Group. Earnings were already 40% down in the first half of 1989, which chairman Carlo de Benedetti attributed to the cost of that restructuring.

But earnings took a further beating in 1989 because of fierce competition in Olivetti's main sector of activity, micros. Micro sales were up 10% to L2.1 trillion, ($1.5 billion), accounting for 27% of IS revenues, nearly the same as 1988. Mainframe sales fell 13% to L145 billion ($105 million) in 1989, slipping to less than 2% of total IS sales.

In October 1989, Olivetti became the first major vendor to introduce a PC based on Intel Corp.'s i486 chip when it announced the CP486 computing platform for its new generation of micros. For its PCs, the company is committed to the Extended Industry Standard Architecture (EISA), although it has not abandoned IBM's Micro Channel Architecture (MCA).

The new platform might help Olivetti improve its lackluster performance in the European micro market, where in terms of unit value it lost its No. 2 position to Compaq Computer Corp. in 1988. Olivetti's market share plunged from 13 to 7.6% between 1985 and 1988, while Compaq's rose to 9.5%.

Olivetti remains particularly strong in banking systems, and in 1989 a bank awarded the company the largest contract in Olivetti's history. The Dutch cooperative banking federation Rabobank, which comprises 900 banks and 2,200 offices in the Netherlands, placed an order worth L500 billion ($364 million) for a complete banking system including 2,000 LSX minis (running under Olivetti's version of UNIX, X/OS) and 25,000 PB workstations (first running MS-DOS and, later, OS/2). The system will be based around Olivetti's Open Systems Architecture (OSA).

Although its five-year alliance with AT&T ended in 1989, Olivetti continued cooperating with other vendors throughout the year. A technology exchange deal with Digital Equipment Corp., allowing Olivetti PCs to be integrated into Digital networks, was followed in April by an agreement allowing Digital to market Olivetti PCs in Europe.

—*James Etheridge*

IS Revenues: $2.81 Billion

REGION		WORLD
4	NV PHILIPS	18

Revenues By Region

N. AMER.	21%
EUROPE	73%
ASIA	6%
OTHER	

NV PHILIPS GL
5621 BA Eindhoven
The Netherlands
(31-40)-79111

Although the information technology and communications business of NV Philips GL performed better than the company overall in 1989, slumping computer sales contributed to a disastrous start for the company in 1990. So bad, in fact, was Philips' first quarter performance this year—when earnings from core operations totaled only G6 million, down from G223 million in first three months of 1989—that two top executives are being forced to resign their positions at the company, effective next month.

Departing from Philips are Cornelius van der Klugt, president, and Gert Lorenz, who had headed up its computer business. Just weeks before Philips announced its first-quarter results, van der Klugt had been predicting an improvement in his company's profitability for 1990. Philips' management now believes it will be difficult to derive more income from existing operations in 1990 than the company did in 1989.

For 1989, total revenues for Philips edged up a meager 2% to G57.2 billion ($26.7 billion). Operating income fell 5.5% to G2.29 billion ($1.1 billion), but net income rose 30% to G1.37 million ($647.8 million). The company's information technology (IT) business posted better performance records than the firm's averages, boosting sales by 8% to G5.97 billion ($2.8 billion) in 1989, although the strengthened dollar gave Philips virtually flat sales when measured in U.S. currency.

Peripherals remained by far the largest single IT category for Philips, generating 33.7% of that sector's revenues, slightly more than in 1988. Microcomputers again recorded the fastest sales growth, soaring 44% to G940 million ($443 million). Minicomputer sales, in contrast, slumped nearly 15% to G750 million ($353 million). The contributions of data communications equipment and maintenance services were more or less stable at 16.2% and 14.1%, respectively.

Earnings from IT sales, however, were poor in 1989, and at the beginning of 1990 this business was reorganized into three separate divisions—information systems, communication systems and applications software—to enable each division to cater more specifically to its particular market.

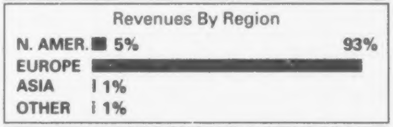
Building on its buoyant micro business, Philips was one of the first vendors to launch a PC based on Intel Corp.'s 33-megahertz 386 TM chip. Announced in May of 1989 and dubbed the P3370, the PC was shipped last fall. This high-end micro supports a variety of operating environments, with MS-DOS 4.0 as standard and OS/2, Presentation Manager, LAN Manager, Microsoft Windows and Novell NetWare optional. At the mini level, Philips extended its P9000 UNIX-based family with a high-end P9600, which has four times the power of the previous high-end model and is designed to handle up to 150 workstations.

In office automation applications, Philips launched a new low-cost optical storage system and its first case-handling application during 1989. The Megadoc family of optical-filing systems was enlarged with the entry level Megadoc-10. Designed for low-volume document storage and retrieval in small working groups within banks, insurance companies and government, it has a capacity of 16,000 pages per disk. Philips' new Documan application electronically creates, stores, routes, monitors and controls access to case folders. Philips is also the main contractor for a European Community project that is developing a case-handling system for the insurance industry.

—James Etheridge

IS Revenues: $2.79 Billion

REGION 5 **NIXDORF** WORLD 19



NIXDORF COMPUTER AG

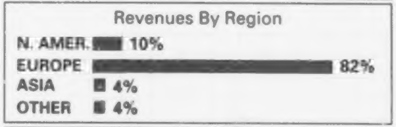
Furstenallee 7
D-4790 Paderborn, West Germany
(49)-525-1150

Nixdorf Computer AG may be enjoying its last year as a separately listed company in the DATAMATION 100. If all goes according to plan, Nixdorf soon will be a part of Siemens AG—the result of a merger proposed last year, one in which Nixdorf struggled.

Nixdorf's information systems revenues in 1989 fell nearly 2% to DM5.25 billion ($2.8 billion). For details on what happened to West Germany's No. 2 computer maker, please see our profile on Siemens.

IS Revenues: $2.64 Billion

REGION 6 **STC** WORLD 22



STC PLC

1B Portland Place
London W1N 3AA, U.K.
(44-01) 323-1000

When STC posted profits in 1989 of £278.2 million ($456.7 million), 10% higher than expected, it should have been welcome news. But it wasn't. Instead, the company's shares dropped slightly in London, where analysts credited the higher figure to the company taking a pension fund holiday, which contributed £36 million ($59 million) to the profit account.

But the initial reaction may have been hasty. STC chairman Arthur Walsh chose not to give the windfall to shareholders; instead, he pumped that money, along with a lot more, into research and development. The R&D budget rose nearly a third £271 million ($443.2 million), with particular emphasis on optical communications and computing.

Among STC's IT divisions, operating profits rose handsomely for the communications operations (26%) and for the components and distribution division (52%). For the eighth consecutive year, operating profits rose at International Computers Ltd. (ICL), STC's information systems subsidiary. ICL rated third of STC's IT divisions, with a 13% increase in profits to £145.7 million ($238.3 million), on revenues of £1.6 billion ($2.6 billion, up 18%), with more than 60% of sales coming from the United Kingdom. The increase, however, was no mean feat these days, particularly as increases in inflation and interest rates in the United Kingdom have squeezed the margins of hardware products.

Still, many questions remain over ICL's future, as STC continues to look for potential partners. The parent company wants to help share research costs at ICL, whose appeal was certainly enhanced with the $168 million acquisition of California-based Computer Consoles (now ICL North America).

Internally, ICL moved to hold down product costs by reducing its manufacturing and logistics operations in the United Kingdom from four sites to three. And in March 1990, ICL reshuffled its Mainframe, Office, Network and Software Services Units into three new divisions: Computer Products, IT Services and Systems Integration. The company says the shift signals its move from a "box supplier" to a "total solution provider."

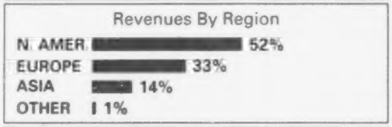
Some 1989 investments enhance that ability. ICL Germany took a 40% share holding in Metatech, a software house specializing in applications for the manufacturing sector. In the Netherlands, ICL established SIAC, a systems and software house with 80 employees. ICL is operating in six Eastern European countries, including two joint ventures—one in the U.S.S.R. for assembling PCs and another in Poland for the local assembly of ME29 mainframes.

In January, ICL introduced its DRS 6000 series, a new range of high-powered, midrange, UNIX-based systems, making ICL the first major international supplier to combine Scaleable Processor Architecture (SPARC)-based reduced instruction set computing (RISC) with the latest version of the UNIX System V.4 operating system. Even before the upgrade, the DRS series won some significant business in 1989, notably from the Spanish Ministry for Social Security and from the Portuguese government. Also this year, ICL plans to introduce its most powerful Essex series mainframes, aimed at large users such as central governments and utilities. *—Tim Harper*

IS Revenues: $2.06 Billion

REGION		WORLD
7	**MEMOREX TELEX**	28

Revenues By Region



MEMOREX TELEX NV
Hoogoorddreef 9
1101BA
Amsterdam ZO
The Netherlands
(31-20) 974-331

With the 1988 merger of Memorex International of Amsterdam and Telex Corp. of Tulsa, Okla., well behind it, Memorex Telex NV began to look out at the world again in 1989. Although the company shipped 11 new products in 1988, last year brought an even stronger emphasis on the company's storage and networking market strategies. Specifically, in 1989 the firm brought out a series of new items, including a large capacity disk drive with a small footprint. IS revenues for calendar 1989 totaled $2.05 billion.

Memorex says the two halves of its company have complementary product sets and a geographical spread that is beginning to show through. The merger created a company large enough to demand a global presence and acquire the resources needed to develop commercially successful new products. On the one hand, Memorex International earned 70% of its sales in Europe and only 30% in the United States. For Telex Corp., on the other hand, the U.S. accounted for 85% of sales. The merged range of products fits well together, as Telex adds vital networking products to Memorex's emphasis on peripherals for large IBM machines.

The AS/400 peripherals market segment is expected to be strategic for the company, which released several products there in 1989. The company hopes to capture 30% of the market within three years. New product introductions include the 5460 cartridge reader, which holds up to 10 cartridges (compared with IBM's 3490, which holds eight). The unit works with both AS/400 and System/38 machines, which makes it useful for sites planning staggered upgrades or those running applications on both systems.

In October, the company started shipping its new IBM 3380-compatible 3890 disk drives and its robotics-based automated tape library.

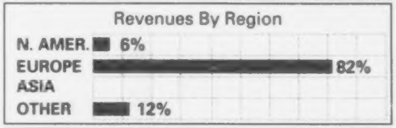
Another important 1989 product release was the 1174 series of remote controllers, which can hook up to four host machines and 96 coax devices. Manufactured at Memorex Telex's factory in Raleigh, N.C., the controllers should be "of key importance to our customers' networking strategies," says the company spokesman.

Memorex Telex made some strides in 1989 as a supplier of software for value-added networks. One such order was to supply workstations, software and service for Galileo, the air travel reservation system being developed by a consortium of European airlines including British Airways and KLM. Galileo promises to be one of Europe's largest value-added network applications. *—Paul Gannon*

IS Revenues: $1.80 Billion

REGION		WORLD
8	**ALCATEL**	32

Revenues By Region



ALCATEL NV
33 Rue Emeriau
75015 Paris, France
(33-1)-40-58-58-58

The enlarged, but more specialized Alcatel NV, created from the merger of the information technology and telecommunications activities of France's Compagnie Générale d'Electricité (CGE) and ITT Corp.'s worldwide telecommunications interests, completed its first three years of operation at the end of 1989 on a buoyant note.

After a slight decline in revenues in 1988, Alcatel achieved a 15% increase in 1989 to European Currency Unit 12.8 billion ($14.1 billion), and net income jumped 43% to ECU478 million ($526 million). (Alcatel is registered as a Dutch company and uses the European Currency Unit for accounting purposes.) Net margins thus rose from 3.2 to 4.1% in 1988. Margins improved despite restructuring costs of ECU223.5 million ($246 million), a sharp increase, practically as much as the costs for the previous two years combined. More than 80% of Alcatel's 1989 revenues came from Europe, with over 28% coming from France alone. North America chipped in 5.8%, and the rest of the world contributed 12.5% of revenues.

The company's four main operating divisions were partially reorganized at the end of 1989, the principal move being to broaden the Transmission Systems Division (which generated 14% of sales in 1989) to form the Radiocommunications, Space and Defense Group.

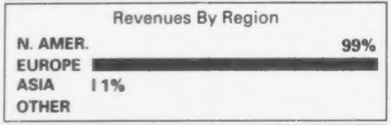
As for the other three units, the Network Systems Group contributed 25% of sales in 1989, Business Systems accounted for 21% and Cables, 28%. The remaining 12% of 1989 sales came from professional electronics and other activities.

Alcatel's strategy is to offer complete network and systems solutions encompassing voice, data, text and image. To that end, it pursues technical alliances that widen its markets and reinforce its product line. In 1989, the firm's French telephone equipment and business systems subsidiary, Télic Alcatel, and IBM France agreed to develop a service and communications bridge between their respective equipment. Alcatel and Siemens AG also announced common specifications for inter-PABX (private automatic branch exchange) signalling in private Integrated Services Digital Networks (ISDNs).

Alcatel secured the rights to manufacture and distribute the high-speed local area network (LAN) switches and software of QPSX Communications of Perth, Australia. Télic Alcatel also signed a 10-year agreement with the Cairo-based Egyptian Telephone Corp., providing for ETC to manufacture the Alcatel 2600 PABX. *—James Etheridge*

IS Revenues: $1.19 Billion

REGION 9 **NOKIA** WORLD 46


Revenues By Region

NOKIA DATA AB
P.O. Box 226
SF-00101
Helsinki, Finland
(358-0) 180-71

Nokia, the highly aggressive Finnish conglomerate, once again has failed to present convincing evidence that its efforts in the computer business will be ultimately successful. Sales of the data division in 1989 totaled 5.1 billion Finnish markka (about $1.2 billion), up only 5% over 1988, but the division managed to break even, at least according to management.

When Nokia acquired and merged the Data Division of the Swedish telecommunications giant LM Ericsson Telephone Co. in January 1988, with its own data operations, observers were skeptical. Ericsson had struggled for several years to try to make the division profitable, but had failed completely.

Nokia, however, has managed to halt the bleeding, creating a data division with a strong position on the Scandinavian market, particularly in banking and insurance. Nokia Data concentrates on packaged solutions of both hardware and software, which are of its own development and manufacture. Its strategy is similar to that of other small makers: open systems, systems integration and a solutions orientation.

Compared internationally, Nokia is a small hardware producer. In fact, in producing minicomputers, PCs and terminals, the firm is more an assembler than a manufacturer. But management insists that being large is not necessarily an advantage. In Scandinavia, for instance, Nokia's IBM-compatible PCs sell well, due mainly to excellent ergonomics.

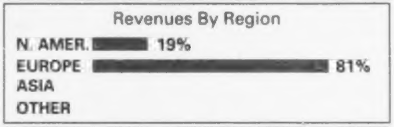
To sell its technology, Nokia divides its business geographically: Finland, Scandinavia and the rest of Europe. The home market, Finland, accounts for 40% of sales. Nokia Data also is an agent for other companies' products in Finland, including Hitachi Ltd. mainframes. Market shares are very high; Nokia is Finland's great hope in high tech, and national chauvinism helps maintain strong sales. Even in Scandinavia, which accounts for 30% of sales, Nokia has a relatively large market share. In Sweden, Nokia is the second-largest hardware supplier after IBM. The picture is completely different in the rest of Europe, where Nokia Data has small market shares and poor profitability.

Nokia Data could be an ideal partner or acquisition candidate for an international computer company that wants to strengthen its market position in Scandinavia. There have been unconfirmed reports that Olivetti is negotiating to acquire Nokia or will work out some kind of cooperative agreement. These rumors started when Olivetti's former vice president, Vittorio Levi, was named managing director of Nokia Data, to succeed Kalle Isokallio as of January 1, 1991.

—Johan Hallsenius

IS Revenues: $1.10 Billion

REGION 10 **CAP GEMINI** WORLD 48


Revenues By Region

CAP GEMINI SOGETI
11 Rue de Tilsit
75017 Paris, France
(33-1)-47-54-50-00

Except for absorbing five small firms specializing in information systems in 1989, Cap Gemini Sogeti concentrated on consolidating and streamlining its organization last year, significantly improving its profitability. The breather was necessary for the group to complete its merger with SESA, the French service company it took control of in late 1987.

As a result, group revenues increased by 21.2% to Fr7.04 billion ($1.1 billion), up from Fr5.8 billion ($976 million) in 1988, while net earnings surged by over 30% to Fr525 million ($82.3 million), up from Fr402 million ($67.5 million). Net margins thus jumped to a record 7.4% from an already healthy 6.9% in 1988. At the same time, the company raised additional funding of Fr1.5 billion ($235.1 million) through an issue of 10-year convertible bonds.

France again accounted for 46% of Cap Gemini's revenues, while other European countries contributed 34% (down from 38% in 1988). The United States chipped in with 19%, up slightly, mainly because of the stronger dollar and some U.S. acquisitions. The company's four main sectors of activity—industry, finance and banking, distribution and services, and telecommunications—each generated at least 20% of revenues, while government (including defense) accounted for around 15%.

Of the five small IS firms absorbed in 1989, two are in the United States: Systemation Inc. of Cleveland, which is strong in systems integration, and Merit Systems Inc., a Detroit service company specializing in industrial IS. The takeovers added annual revenues of $40 million, boosting Cap Gemini America's revenues to $230 million in 1989. In Europe, Cap Gemini acquired a small Swedish firm, Accept Data, based in Stockholm, which develops financial systems, and two French firms, Apsis and Aptor, both based near Grenoble, specializing in industrial systems.

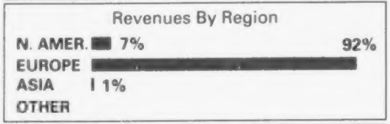
Within the company's existing organization, its Italian subsidiaries had a particularly good year in 1989. Milan-based Cap Gemini Geda picked up contracts from the new Milan airport; the Italian national railway, Ferrovie dello Stato; and from the city of Rome for a town-planning database and management system. Rome-based SESA Italia (now Cap Gemini Italia) was awarded a systems integration contract for the European space shuttle project Hermes. Elsewhere in Europe, the Royal Dutch Navy retained Cap Gemini to develop a complete stock control and procurement system, while a Swedish hydroelectric power consortium contracted Cap Gemini's Swedish subsidiary, Cap Gemini Logic, to develop a system for power distribution management.

In preparation for the unified European market, Cap Gemini Logic and Cap Gemini Pandata, the firm's Dutch operation, were reorganized in 1989 by merging several subsidiaries into single vertically structured units in each country. In February 1990, Cap Gemini also established an international support group in Paris.

Finally, responding to the demands of its customers, Cap Gemini has begun to diversify into more general corporate consulting with the acquisition in January 1990 of a 67.5% holding in Gamma International, a Paris-based management consulting firm. *—James Etheridge*

IS Revenues: $819.1 Million

REGION **11** **MANNESMANN** WORLD **54**



MANNESMANN KIENZLE GMBH
Postfach 16 40 7730 VS-Villigen
West Germany
(49-7721)-671

1989 is the year Mannesmann Kienzle GmbH stopped merely supporting standards-based systems and started to push them. At least that's what one company spokesman says. The goal was a smooth transition between Mannesmann's proprietary operating systems, MTOS and UNIX. The means was its first UNIX-based business system series, the 2000, which formed a bridge between the company's 9000 family and "the world of UNIX."

To focus attention on its new solution, the company increased promotion of its Kienzle Integrated Digital Area Network (KIDAN), a local area network (LAN) that enables communication between the 9000 and 2000, as well as other systems. Mannesmann also introduced 15 new application software packages for the building, trade and service industries last year.

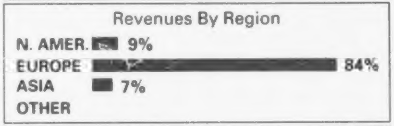
Revenues totaled DM1.86 billion ($986 million) for calendar 1989. Following the restructuring that split the group into independent business divisions, Kienzle Computer Systems reported a 5.8% rise in revenue, Mannesmann Tally (printers) reported a 13.8% increase and PCS Computer Systems reported a jump of 19.3%. DATAMATION estimates Mannesmann's total IS sales in calendar 1989 to be DM1.5 billion ($818.6 million), a rise of 12% over 1988's figures.

In telecommunications, Mannesmann turned its attention to the Integrated Services Digital Network (ISDN) and to finding ways to combine computers with telephones. To that end, the company teamed up with Siemens AG in a venture called PBX and Computer Teaming (PaCT). PaCT's first task was connecting Mannesmann terminals to computers using Siemens' Hicom private branch exchanges (PBXs)—a first step toward what Mannesmann calls computer-aided telephoning. To complement last year's developments, the company introduced a new line of fax machines that are compatible with the standards of the Consultative Committee on International Telephone and Telegraph (CCITT).

Mannesmann ended 1989 with an accent on mobile communications, winning the West German Post Ministry license for the country's second pan-European digital cellular communications network. Mannesmann's Dusseldorf-based subsidiary, Mannesmann Mobile Funk GmbH, heads the consortium, joined by partners Pacific Telesis International, based in San Francisco, and Cable and Wireless PLC in the United Kingdom. Mannesmann plans to install and market services by 1991. *—Peggy Trautman*

IS Revenues: $717 Million

REGION **12** **AMSTRAD** WORLD **59**



AMSTRAD PLC
Brentwood House
169 King's Road
Brentwood, Essex CM14 4EF, U.K.
(44-277) 228-888

In many ways, 1989 was another dismal year for Amstrad PLC, with a continuation of the volume woes—sales too low, inventories too high—that always mean trouble for a marketing company. And Amstrad, whose business centers on PC clones, has always insisted that it is a marketing company, rather than a technology company or even a computer company.

But 1989 may be regarded as the year that Amstrad and its mercurial founder-chairman Alan Sugar, began to turn things around. After inventories climbed to £335 million ($548 million) and net borrowing rose to £114 million ($186 million) last autumn, Amstrad's shares slumped 82% on the London exchange. For the first time, Sugar admitted that Amstrad had made mistakes in virtually every aspect of its rapid expansion.

Several new executives came in to beef up the floundering senior management, led by a new group finance director, Peter Thoms. By early 1990, the company was in a cash neutral position, and inventories had been sliced to a more acceptable £220 million ($360 million), with a goal of £150 million ($245 million) by the end of the year. And despite months of suffering from rising British interest rates, Amstrad's results for the second half of 1989 showed pretax profits of £30 million ($49 million), almost doubling analysts' expectations.

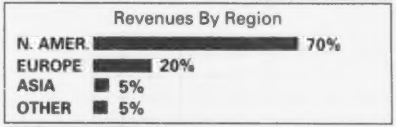
The company also brought new management into Spain, the United States and West Germany. One mistake, Sugar said, was that a lack of cost monitoring and controls in those countries (which are now in place, he says) led him to overemphasize revenue growth.

Sugar is pinning high hopes on a new venture with London-based STC PLC in Belfast, Northern Ireland, to produce a reliable, attractively priced telefax machine for the home and small office. The company formed two other major manufacturing alliances during 1989, one with Marconi for satellite equipment and another with GPT, part of GEC-Siemens, for its top-end 80386- and 80286-based PC 2000s. About 7,000 of those machines had to be recalled during 1989 because of hard disk problems. To improve product quality and service, Sugar's new managers will put more emphasis on research and development and will provide more direct support for end users.

Sixty percent of Amstrad's business is done abroad, but its efforts remain patchy. The company is well pleased with its subsidiaries' performances in Australia, Italy and West Germany, for instance, but has been disappointed in the United States and is expecting a continued slide in Spain. Eastern Europe is seen as a major potential market, led by a deal unveiled in early 1990 to sell 40,000 PCs to the Soviet Union. *—Tim Harper*

IS Revenues: $692.5 Million

REGION **13** **BRITISH TELECOM** WORLD **62**



BRITISH TELECOMMUNICATIONS PLC
81 Newgate Street
London EC1A 7AJ, U.K.
(44-1)-356-5000

British Telecommunications PLC is not generally known for the spectacular, but in 1989, British Telecom of-

British Telecom has spanned the globe for acquisitions.

ficials began taking a brash approach, seizing every opportunity to demonstrate that it wants to become the world's most successful telecommunications company. Even amid the economic fluctuations and fears running through Britain in late 1989 and early 1990, its share prices rose, and British Telecom lost its reputation for being an undervalued stock.

The market may have perceived that the company is a bit closer to its stated goal due to a pair of major acquisitions made during 1989.

The company purchased Tymnet's network systems business and its associated applications from McDonnell Douglas Corp. for $355 million. BT's worldwide network systems and network applications business, which accounted for some £220 million ($360 million) in 1989 revenues, is now being run by the wholly owned British Telecom subsidiary BT Tymnet Inc. in San Jose. The second significant acquisition was a 20% stake in McCaw Cellular for $1.37 billion. McCaw's ownership or interest in 130-some cellular telephone operations throughout the United States gives British Telecom the opportunity to build its long-dreamed-of national cellular network in the United States.

In 1989, British Telecom also entered a joint venture with OTC Australia. The new company, Network Innovations PLC, will manage the OTC Dialcom public electronic mail service, as well as develop, market and support other value-added services in Australia.

At home, fierce competition from Mercury Communications Ltd., which is expanding its services from long-distance to pay phone calls, is a nagging issue. The increased competition has caused BT executives to be quite vocal in criticizing the U.K. government's regulatory policies. While BT applauds the ideals of those policies, which it calls the most open in the world, it complains that the regulations are hurting the company both domestically and abroad.

BT is also reviewing its position as a private branch exchange (PBX) manufacturer. In January 1990, British Telecom announced that it might sell all or part of its 51% shareholding in the Mitel Corp. The disclosure demonstrated that BT does not see PBX manufacturing as an essential part of its global network services strategy.

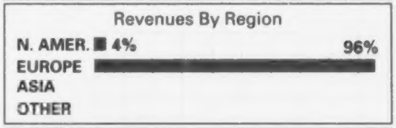
British Telecom's major growth markets will be in mobile communications and data communications, including two international paging operations: Metrocast, which is already operating in the United Kingdom and United States, and Euromessage, which was scheduled for a Spring 1990 launch in France, Italy, the United Kingdom and West Germany. And, although the company is saying little about it, analysts believe a key part of the 1990 strategy is to chase the 20% of TELEMEX being offered by the Mexican government.

Along with the business changes and expansions, British Telecom is hoping to improve its image of poor quality service by modernizing the phone system. Analysts believe one potential roadblock to accomplishing this is the high cost of giving its engineers pay raises of perhaps 10%. In March, 1990, the company announced a restructuring that could result in a loss of 10,000 employees over the next three years. —*Tim Harper*

IS Revenues: $662.5 Million

REGION		WORLD
14	FINSIEL	64

Revenues By Region



FINSIEL SPA
Via Isonzo, 21/B
00198 Rome, Italy
(39-6)-851505

Finsiel SpA (Finanziaria per i Sistemi Informativi Elettronici), Europe's second-largest software company, is taking an active part in Euromethod, the European Community project aimed at defining standard software development methodologies. Finsiel is already a key player in this effort through the distribution of its Dafne methodology and various computer-aided software engineering (CASE) tools.

In 1989, Finsiel also looked beyond Europe. Through its research and development group, Tecsiel, Finsiel has taken another step toward standardization by cooperating with groups espousing standards, such as X/Open Co. Ltd. Tecsiel has also signed agreements with Fort Lee, N.J.-based On-Line Software International Inc. and France's TITN-Alcatel to encourage the global distribution of its software packages. Finsiel also signed an agreement with the U.S.S.R. State Committee for Computers and Information Sciences for joint development of application and systems software.

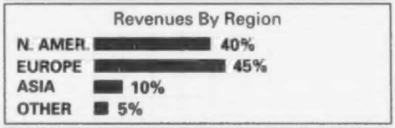
Finsiel's 1989 revenues rose 28% to L908.7 billion ($662.5 million). To boost Finsiel's future prospects, the state-owned Instituto Riconstruzione Industriale, Finsiel's major investor, increased its investment in the company, boosting capital to L52 billion ($38 million).

—*Simone Gozzano*

IS Revenues: $573.9 Million

REGION		WORLD
15	RACAL	68

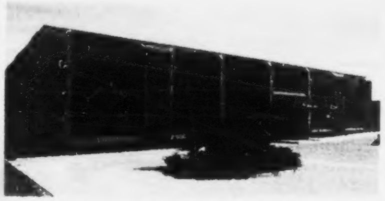
Revenues By Region



RACAL ELECTRONICS PLC
Western Road
Bracknell, Berkshire
RG12 1RG, U.K.
(44-344) 481-222

In 1989, Racal focused on expanding its technology base and continued its steady move away from hardware production into systems, managed networks and network services—a strategy the company plans to pursue at least for the next several years. Sales of Racal data communications products rose 12.7% in 1989 to £350.9 million ($574 million).

Last year, British Prime Minister Margaret Thatcher inaugurated the Government Data Network, a Racal-managed service for the U.K. government, which was the centerpiece of a 10-year, $510 million contract Racal won in 1988. As part of a follow-on to that network, Racal



At Racal in Hampshire England the focus has moved to systems.

Data Networks Ltd., a subsidiary of the Racal Data Communications Group, is in discussions with the U.K. government for an integrated voice and data service. Another 1988 contract, for a managed voice service for the U.K. Department of Social Services, went live in September 1989. And a new contract for the Data Communications Group went to Sunrise, Fla.-based network systems supplier Racal-Milgo for the communications infrastructure of the Channel Tunnel project.

For these and other projects, the technologies that will drive the company in the 1990s include high bandwidth local area networks, internetworking, high bandwidth circuit and packet switching, open systems standards, full-service network management, voice-data integration and Integrated Services Digital Networks (ISDN). Racal's ability to expand into these technology markets was bolstered last year by a trio of acquisitions: the DCA Network Communications Group (being merged with Racal-Milgo), specializing in T1 digital communications and OSI network management; Quanta Communications Systems Inc. (now trading as Racal Quanta), a fiber optics communications company; and Interlan Inc. (now trading as Racal Interlan), a leading U.S. local area network company.

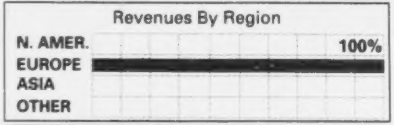
The United States remains Racal's biggest source of revenue, but Europe is the fastest growing market. Racal's home market, the United Kingdom, accounts for 23% of its total worldwide sales.

Among the moves designed to improve its internal organization, Racal consolidated all its U.S. manufacturing, including that of Racal-Milgo and its Racal-Vadic modem maker, at a single site in Miami.

Racal believes the factors most critical to its future success include first-class distribution channels, product cost reductions, innovation and effective network services. —*Tim Harper*

IS Revenues: $566 Million

REGION		WORLD
16	COMPAREX	69



Revenues By Region

COMPAREX INFORMATIONS-SYSTEME GMBH
Gottlieb-Daimler-Strasse 10
D-6800 Mannheim 1, West Germany
(49-621)-40090

A decrease in the demand for compatible mainframes resulted in continued price decreases. This, compounded by problems in disk storage system deliv-

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eries, kept Comparex Informationssysteme GmbH's revenues for 1989 down to DM1.06 billion ($566 million)—about 1.5% below the previous year's figures.

Speculation concerning the Hitachi Ltd. takeover of National Advanced Systems Corp.—a major competitor of Comparex in Europe—fueled speculation about how that acquisition would affect products Hitachi supplied to Comparex in Europe. That speculation had a negative effect on Comparex's sales.

However, chairman of the board Rolf Brillinger calls the firm's 3% earnings on revenue satisfactory, adding that such figures show that Comparex "is thoroughly sound and has proved it can hold its position even against extremely tough competition."

Comparex West Germany contributed the most to total corporate revenues with DM482 million ($256 million), although its growth remained static. Other European subsidiaries reported increases in their market shares, with Belgium, France, the Netherlands, Spain and Switzerland all recording double-digit growth. The firm's work force rose 2% in 1989 to 1,145 employees worldwide, as a result of increased sales by the subsidiaries. Sales to partnership companies, however, decreased by 15% in 1989 to DM153 million ($81 million), due to a limited availability of Comparex's products.

Over half of Comparex's sales are peripherals. Comparex's 3090-class mainframes accounted for 32% of domestic revenues, and services chipped in 16%.

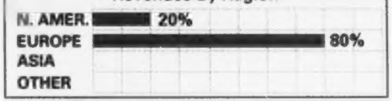
Particularly high demand for disk storage systems and a holdup of their delivery from Hitachi produced a backlog of orders that couldn't be completely made up in the second half of the year. However, despite these setbacks, Brillinger says he expects sales of 3090-class CPUs, peripherals and service products to increase in the 1990s. Sales for those goods, he says, will get a shot in the arm from increased trade with Eastern Europe and an eventual change in the rules set by the Coordinating Committee for Multilateral Export Controls (CoCom).

—Peggy Trautman

IS Revenues: $431.5 Million

REGION		WORLD
17	SD-SCICON	83

Revenues By Region



SD-SCICON PLC
Centrum House
101-103 Fleet Road
Fleet, Hampshire GU13 8NZ U.K.
(44-252)-622-161

SD-Scicon, born out of the 1988 merger of two British software houses, Systems Designers and Scicon International, focused in 1989 on assimilating the two companies and defining the principal markets for the new, combined company. In that first full year of operation, SD-Scicon realized IS revenues of £263.8 million ($431.5 million), up 28% over 1988. The combined company was inaugurated formally in January 1990,

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with Philip Swinstead as chairman and Ian Scoggins and Geoff Holmes as joint chief executive officers.

SD-Scicon has decided to concentrate on Europe. It will not pull out of the United States completely; its vehicle-emission testing programs are used by many states. However, the company sees itself as a niche player and says its resources are not suited to a market as vast and competitive as the United States. But Europe seems more manageable and, with the democratization of Eastern Europe and the prospect of fewer trade barriers in 1993, appears to offer much more growth potential.

One result of the decision to stay close to home was SD-Scicon's early 1990 sale of Warrington Financial Services, a U.S. on-line bond-trading consulting company, to another U.S. firm, Sungard Data Systems Inc. of Wayne, Pa. The $65.3 million Warrington sale provided £24 million ($39 million) in after-tax capital that can be used to finance further expansion in Europe. Part of that expansion may be some sort of alliance with Sligos of France; SD-Scicon will say only that the two companies are in wide-ranging discussions.

Internally, one of the most notable aspects of SD-Scicon is the company's commitment, from the chairman's office on down, to a "total quality management" program. While many companies dabble in these programs, SD-Scicon's top people seem determined to make it stick over however many years it takes to build an infrastructure of quality-oriented management geared toward making the right decisions the first time.

In Europe, SD-Scicon sees the 1993 drive toward harmonization as opportunities for that new business, both for its technical products and professional services. In products, expected growth areas include facilities management, particularly in plant maintenance and manufacturing applications, and in communications, particularly the X.400 market. In professional services, the company sees itself becoming more in demand for both systems integration and turnkey projects.

—*Tim Harper*

IS Revenues: $400.7 Million

REGION		WORLD
18	**SLIGOS**	**89**

Revenues By Region

SLIGOS
3 Place de la Pyramide
Cedex 49
92067 Paris La Defense, France
(33-1)-49-00-90-00

Sligos, France's second largest computer services company, enters the DATAMATION 100 after another year of healthy revenue and earnings growth. It did not have far to go, since in 1988 it was in 101st place worldwide, after recording a 46.2% jump in revenue (mainly due to acquisitions) to top the Fr2 billion ($343 million) mark. Revenue advanced a further 25% in calendar 1989 to about Fr2.6 billion ($401 million), while after-

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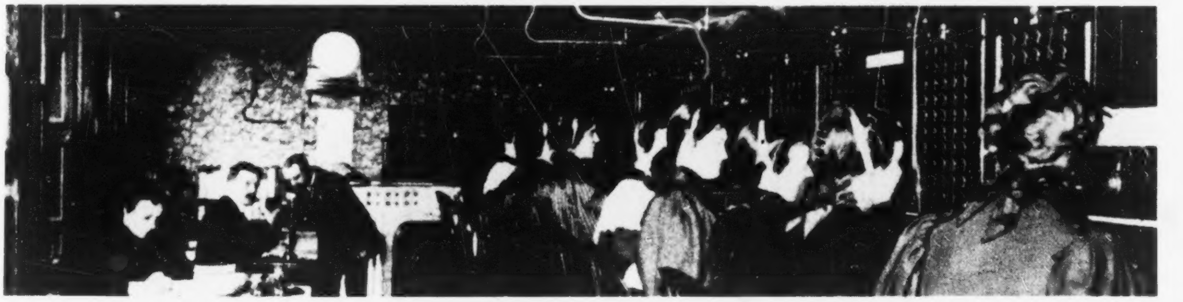

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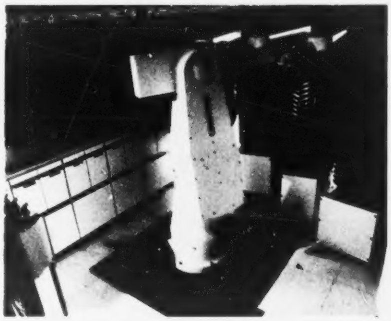
tax earnings were up about 36% to Fr134 million ($21 million). Net margins were thus restored to 5.3% following a dip to 4.85% in 1988.

Although Sligos has been a publicly quoted company since 1986, it is controlled by one of France's big four banks, Crédit Lyonnais, which retains a 62.8% holding in the company. That partly explains the importance of the financial sector in Sligos' total business: banking systems, electronic payment processing and ancillary services account for 36% of revenues. However, systems engineering, including industrial systems, remains the biggest activity, generating 46% of revenues (27% from large systems and 19% from microcomputers). The remainder comes from customized software packages for small and medium-sized companies (10%) and value-added services (8%).



Comparex's automotive cartridge library can handle 21,000 cartridges.

For all of its strength in banking and electronic payments, Sligos had no direct presence in West Germany up until its acquisition in 1989 of a 70% holding in Stuttgart-based Actis, which specializes in banking systems and electronic data interchange (especially for the automobile industry) and had revenues of DM27 million ($14.4 million) in 1989.

With the takeover of Actis, the proportion of Sligos' revenues derived from outside France has more than doubled, to around 9%. The company also owns the Spanish company Poli-Rub, based in Barcelona; has a 60% stake in Cortram Systems Ltd. of Valhalla, N.Y.; and a 70% stake in subsidiary Sligos Côte d'Ivoire, based in Abidjan, Ivory Coast.

By 1993, when it expects 15 to 20% of its revenues to come from outside France, Sligos hopes to double its revenues to Fr5 billion (about $785 million). To help it expand its operations elsewhere in Europe, the firm has entered into an informal alliance with the U.K.'s biggest service company, SD-Scicon PLC. No shares have changed hands, but the two are exploring avenues that would enable both to cater more effectively to the European market. —*James Etheridge*

IS Revenues: $378.6 Million

REGION		WORLD
19	SEMA GROUP	95

Revenues By Region

N. AMER.	
EUROPE	100%
ASIA	
OTHER	

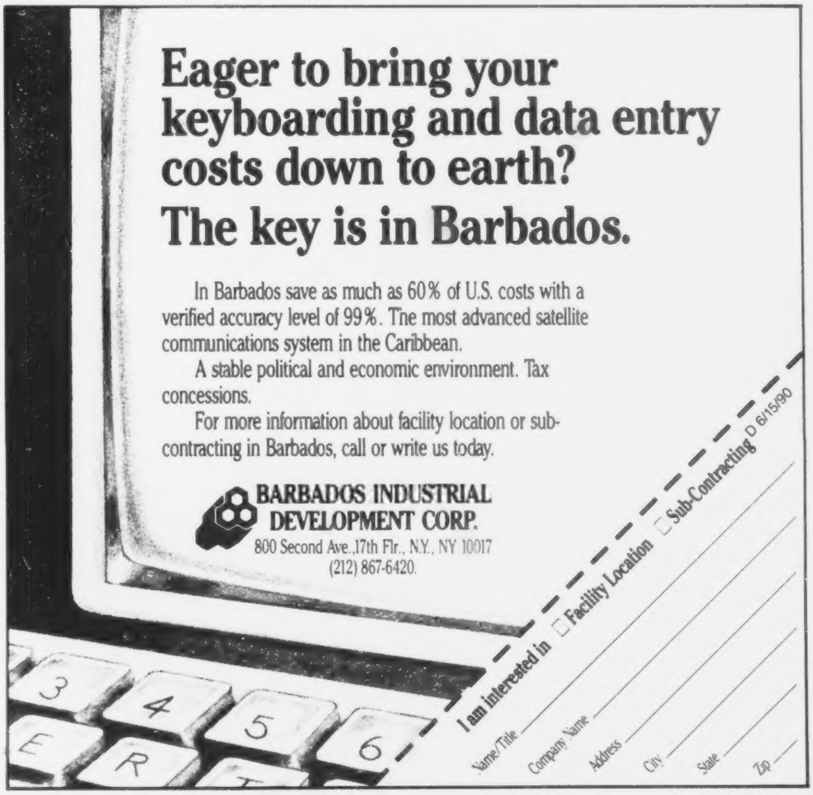
SEMA GROUP PLC
22 Long Acre
London WC2E 9LY, U.K.
(44-1)-379-4711

At the end of his first year at the helm of this Anglo-French software and services company, managing director Pierre Bonelli was able to announce a 35.7% jump in pretax earnings to £17.5 million ($28.6 million) on a 9.8% increase in revenues to £293 million ($479 million). Sema Group PLC's 1989 information systems revenues in particular were up 8.4% to £228.5 million ($374 million).

As in 1988, almost 90% of Sema's IS revenue last year came from systems engineering and integration, with the rest coming from facilities management. The market breakdown was also unchanged from the year before: banking and finance generated 24%; manufacturing 21%; defense and aerospace 15%; nonfinancial services 10%; energy, transportation and government 8% each; and telecommunications 6%.

France again accounted for 41% of the company's revenues, while the British share fell to 37% from 40% in 1988. A further 8% came from Spain, 6% from Belgium, 5% from the rest of Europe (essentially West Germany and the Netherlands) and 3% from the rest of the world (North America and Singapore).

Bonelli restored margins at both the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U.S. and Dutch operations by reorganizing senior management, setting more realistic revenue targets and instituting tighter financial control and reporting systems. He also achieved his goal of expanding the company's activities in West Germany in December of 1989, when Sema acquired a 50% holding in a leading German software company, ADV/Orga F.A. Meyer AG of Wilhelmshaven. ADV/Orga lost a hefty DM14.2 million ($7.5 million) on sales of DM80 million ($42.5 million) in the year ended June 30, 1989, but Sema has trimmed the firm's work force from 600 to 500, and the scaled-down operation is expected to generate revenues of DM60 million ($32 million) in 1990.

Further European expansion occurred in January 1990 when Sema's new Swiss subsidiary started operating in Geneva. The following month, Sema acquired a 49% stake in a French financial systems company, Tibet, and took over German market research Emnid GmbH.

The largest slice of new business for Sema in 1989 was a $65 million contract for the design and supply of command and control systems for the Royal Navy. The company also signed a licensing agreement with Credit Card Software Inc. of Orlando, Fla., early in 1989 for the exclusive marketing rights to its Cardpac credit card processing system in Western Europe and the Far East.

—James Etheridge

IS Revenues: $358.1 Million

REGION		WORLD
20	**NORSK DATA**	99

Revenues By Region

N. AMER.	1%
EUROPE	99%
ASIA	
OTHER	

NORSK DATA AS
Olaf Helsetsvei 5
P.O. Box 25, Bogerud 0621
Oslo 6, Norway
(47-2)-62-60-00

Norsk Data AS, the Norwegian minicomputer maker, was widely acclaimed a few years ago as one of Scandinavia's greatest modern corporate successes. But no longer: 1989 was a year of extremely tough work and painful reorganization.

Norsk Data was hit by a financial crisis in 1988, which continued through calendar year 1989 when pretax losses climbed to 417 million kroner (about $61 million) from NKr323 million ($50 million) in 1988. At the same time, sales declined nearly 16% to NKr2.5 billion ($358 million) compared with NKr2.9 billion ($450 million) the previous year.

Losses in the second half of 1989 were less than in the first half and were largely due to a sharp reduction in personnel. During the year, the company cut its worldwide work force of 4,200 by almost one-third.

Included among those let go was Rolf Skår, Norsk Data's charismatic president. Skår, one of the company's founders, had headed the firm since the early 1970s. The board recommended Skår's removal on grounds that Norsk Data needed a financial specialist rather than a technician at the helm. Executive vice president Erik Engebretsen, who was formerly responsible for finance, sales and marketing, was named president.

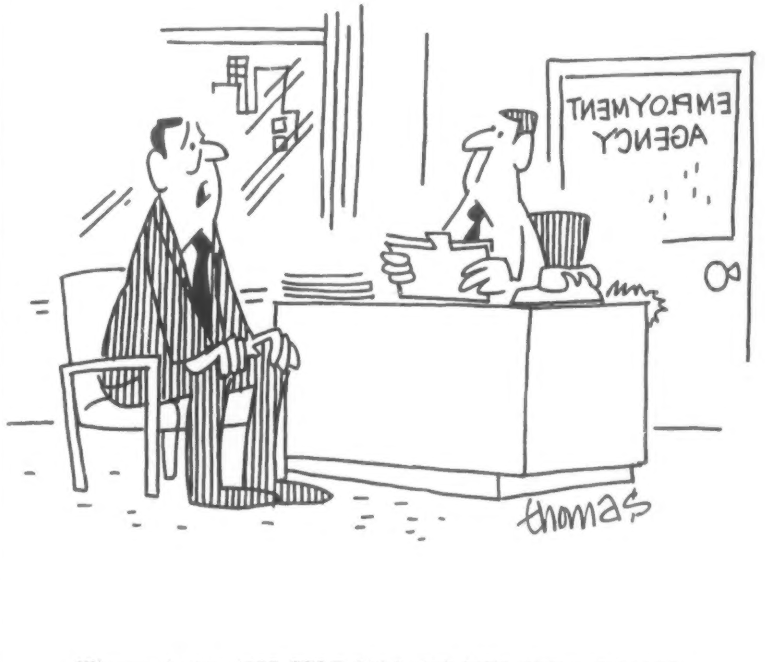
Engebretsen has continued to implement the survival strategy that was formulated during the last part of Skår's term. Like so many other problem-plagued minicomputer makers, Norsk Data is putting its hopes on open systems, reduced instruction set computing (RISC) and the UNIX operating system, as well as systems integration and support.

As part of its survival strategy, Norsk created an independent company out of its research and development department. Dolphin Server Technology AS sells developments to, and accepts R&D assignments from other minicomputer makers. Dolphin's business is based on two products: the Triton 88, a high-performance UNIX network server, and the Orion, a follow-on server with higher performance. Orion is expected to be introduced in the first half of 1992.

Norsk's new president has also continued dividing the company into independent market-oriented profit centers, including central and local government, the newspaper industry, and small companies.

Even if some improvement in performance is seen by autumn, real cost savings are not expected to show up until 1991. First-quarter figures indicate that orders are up 1%. But it remains to be seen if this and the restructuring are sufficient to enable Norsk Data to survive as an independent systems supplier.

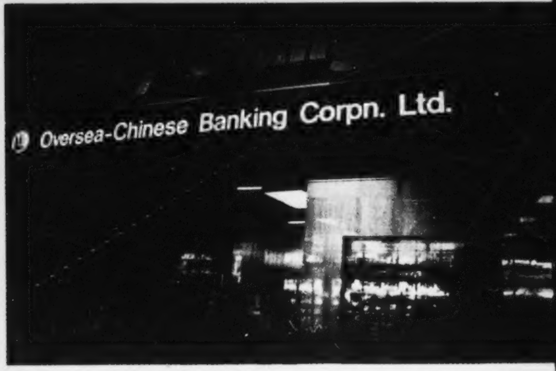
—Weje Sanden



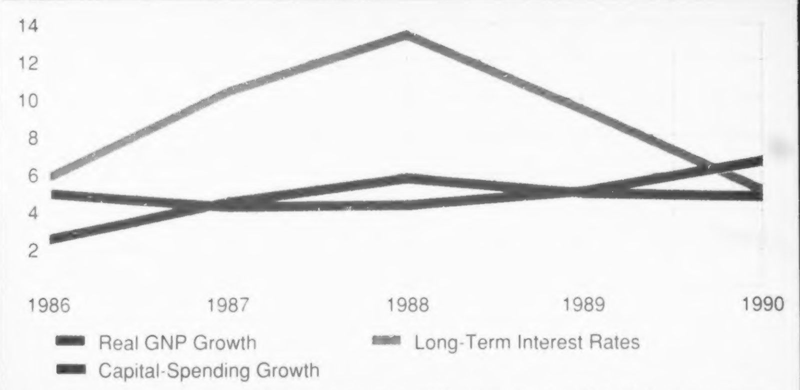
"I've worked for IBM, AT&T, MCA, CIT, NBC, ABC and the CIA. Now I'd like to work for a company that has a real name."

The volatility of the Japan stock market could cause the whole region to shake.

Insatiable demand for consumer suppliers at the leading edge.



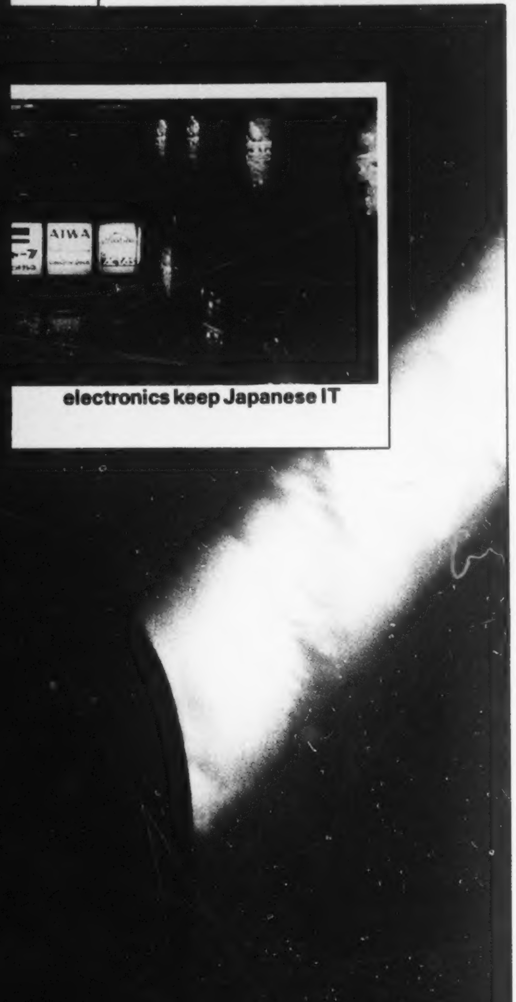
Automated banking at Singapore's airport is but one sign
IT health in Southeast Asia.



What's Driving the Asian Economy

Sources: International Monetary Fund and World Economic Outlook

THE DATAMATION 100



An economic boom in Southeast Asia should offset slowing growth in other Asian markets to create a double-digit rate of growth in information technology spending.

Why Japan Isn't The Hottest IT Spot In Asia

In the Pacific Rim, the Japanese economy is showing signs of the strain from its surging growth of the last few years, and the rates of economic growth in three other major markets—Hong Kong, South Korea and Taiwan—are moderating. Further south, however, the booming economic engines of Singapore and newly industrializing Thailand and Malaysia are creating an acute, urgent need for a stronger IS infrastructure. Such spectacular growth in Southeast Asia combined with respectable growth in other East Asian markets should fuel a 12 to 18% increase in information technology investments in the region in 1990.

"Inherent demand is enormous," says Bruce D. Johnson, director of Baring Securities Ltd. of Tokyo. "[But] we're in sort of a year-to-year relative position, that the economic

BY MARSHA JOHNSTON

cycle is slowing in East Asia. So compared to last year, we might see some slowing in the consumer-demand-related parts of it . . . [in] products individuals buy, PCs and some of the consumer telecom products. However, in the public demand, there is vast pressure to spend money for a wide variety of reasons. One is seeing enormous infrastructure investment, you know, like first-time industrialization [in Southeast Asia]."

The vibrancy of the region's growth is, however, closely tied to developments in Japan's economy. If the tightening of interest rates undertaken by the Bank of Japan at press time does not succeed in choking down further rises in over-inflated property prices and in coaxing the stock market down, Japan's economy could sink dramatically. Such a major collapse would ultimately drag down the region, since a high percentage of its economic growth, particularly in Southeast Asia, is predicated on Japanese investment.

Potential Political Unrest

A political jolt to the region could have the same effect. Undeniably, the region has some potentially explosive political wild cards—namely the often tense, pending reintegration of the People's Republic of China and Hong Kong, Taiwan's new political regime and its recent student unrest. But it's highly unlikely that anything worse than Tiananmen could happen that would depress the climate for investment in information technology.

Barring such economic or political shocks, the economies and concomitant demand for information systems should expand, with telecommunications, PCs and laptops leading the way. Certainly, the stars of growth in the eastern side of the Pacific Rim this year will be in Southeast Asia. "Singapore is by far the larger growing area," says Vangell M. Rafael, director of Software Vision Consultants of Hong Kong, who has worked many years in Southeast Asia for IT suppliers such as lessor Econocom International BV, which is based in Amsterdam. Its IS growth, he says, has flattened out in the last two years, "but it's still a bigger marketplace for companies than Hong Kong. Hong Kong makes sense to companies to be here for geographic/financial tax reasons, but it's not as large as Singapore and, for example, emerging Malaysia and Thailand."

Top Asian Achievers

Asian companies with the healthiest IS revenues

ASIAN RANK	WORLD RANK	COMPANY	IS REVENUE ($ MILLIONS)
1	3	NEC	11,480.4
2	4	Fujitsu	11,378.9
3	6	Hitachi	8,719.0
4	13	Toshiba	4,595.1
5	14	Canon	3,783.3
6	15	Matsushita	3,663.7
7	24	NTT	2,254.0
8	25	Nihon Unisys	2,112.7
9	29	Mitsubishi	2,025.7
10	30	Oki	1,952.0
11	33	Ricoh	1,799.5
12	40	Seiko Epson	1,449.5
13	42	C. Itoh	1,345.9
14	72	CSK	520.0
15	75	Acer	493.7
16	86	Alps	420.4
17	94	Mitac	380.0
18	97	Kyocera	366.4
19	105	Sony	326.1
20	106	Nomura	322.0
21	107	Intec	321.8
22	156	Daewoo	126.9

The Market in Malaysia

According to the 1989 annual report from Bank Negara, Malaysia's national bank, the Malaysian economy should grow by about 8.3% in 1990, due in large part to a three-year-old boom in foreign investment. That boom has resulted from rising costs in Japan, South Korea and Taiwan; appreciating foreign currencies; and infrastructural bottlenecks in Thailand. Barring inflation and unreasonable wage demands, Malaysia could sustain the growth until 1995, says Jaafar Ahmad, a senior economist at the bank. Private economists have noted that previous forecasts by the bank have been conservative.

Despite a communications infrastructure that makes it difficult even to complete a phone call, Thailand's National Economic and Social Development Board expects the 1989 economic growth rate to have been higher than its previous estimate of 10 to 11%. The board also revised its 1988 growth figure from 11 to 13.2%, the highest in 30 years.

"Thailand has great potential if they can overcome the problems of roads and data communications," says Software Vision's Rafael.

Because the local phone system can't cope with the volume of business in Thailand, cellular communication systems are growing by leaps and bounds. Baring Securities' Johnson says that even the cellular systems, however, get clogged up due to heavy traffic. PC use in Thailand is also proliferating. Taiwan-based Acer Inc.'s distributor, Sahaviriya, reported that its 1989 sales soared 50% to 1 billion baht ($40 million) over 1988's 683 million baht ($27.3 million).

In producing PCs, Singapore now makes them more cheaply than Taiwan, according to Takashi Nakatani, general manager for NEC Corp.'s Asia Business Systems Division. Indeed, adds Rafael, "Singapore's interested in developing the infrastructure to supply the hardware as well as the software. The government wants Singapore to be the Silicon Valley of the Far East and is throwing a lot of money into that."

Since it has few natural resources other than its people, Singapore is capitalizing on that to take a lead in emerging technologies. "Singapore is the best example of people who are trying to capitalize on what skills they have. The Singaporeans are investing in the future. Hong Kong Chinese are reaping what they can before the future

Big Exporters in Asia

Asian companies with the most IS sales outside their home markets

	1989		IS REVENUES			
	RANK	COMPANY	N. AMER.	EUROPE	ASIA	OTHER
1	14	Canon	1,324.2	945.8	1,513.3	0.0
2	30	Oki	1,464.0	253.8	175.7	58.6
3	4	Fujitsu	910.3	455.2	10,013.5	0.0
4	6	Hitachi	871.9	348.8	7,498.4	0.0
5	3	NEC	688.8	459.2	10,332.4	0.0
6	15	Matsushita	439.6	293.1	2,931.0	0.0
7	40	Seiko Epson	420.4	289.9	739.3	0.0
8	33	Ricoh	503.9	197.9	1,097.7	0.0
9	13	Toshiba	275.7	367.6	3,951.8	0.0
10	42	C. Itoh	336.5	134.6	807.5	67.3

Revenue figures are in millions of dollars.

disappears," Rafael says.

Indeed. The leading Singapore newspaper, *The Straits Times*, frequently carries advertisements for people with expertise in gallium arsenide manufacturing. Singapore has had a countrywide electronic data interchange (EDI) system for trade transactions since January 1989, and Singapore Telecom recently announced an agreement with several foreign telephone companies to implement the first submarine fiber optic cable to span the Indian Ocean from Southeast Asia, through the Middle East, to Europe.

Seeing such projects through should not pose a problem, as "there's no shortage of cash in Southeast Asia; they've got the money in the economy," says Alan Bell, also of Baring Securities. "I think their political clout is such that they can attract the right sort of investment."

Is Japan's Downturn Just Beginning?

Much of such investment will come from Japan, unless the instabilities that still exist in the Japanese financial infrastructure—a weakening yen, higher interest rates, lower growth in corporate profits and an over-inflated property market—create an economic crisis. It is impossible to predict an upheaval, however. Some financial authorities, such as Credit Lyonnais, say the downturn is just beginning. Others, such as Daniel Gressel, an economist for G.T. Capital Management in San Francisco, contend that Japan's stock market declined in accordance with the natural laws of equilibrium.

The dire predictions do not account for the fact that the Japanese economy has successfully weathered worse times, namely the free-fall of the dollar and the oil embargo of the Organization of Petroleum Exporting Countries (OPEC). Investment banker Barclays de Zoete Wedd of Tokyo, says the wobbly economic factors should not prevent close to a 10% increase in capital investment in fiscal year 1990. It says Japan's severe labor shortage and growing domestic demand should fuel investments such as information systems that are designed to increase production capacity. Barclays expects about one-fifth of overall Japanese corporate investment in FY90 to go toward such expenditures, including IS. Consolidation in many industries in Japan, notably finance, is also creating pressure to spend money on technology.

The labor shortage, combined with political motivations of the ruling party to mend its tattered image with better service to its citizens, will ensure that the government IT market thrives this year. Bell says computerization in Japanese governmental organizations is happening, in particular, due to "the inability of government to hire people to do mundane things." As a result, he adds, optical disks are being used by local governments, the Ministry of Finance and the Japan Patent Office to store tax records, corporate records and patents, respectively.

The financial industry is a prime example of the consolidation in Japanese industry that is driving technology investment. "Virtually the whole of Japan is a series of local [financial] monopolies," says Baring Securities' Johnson. "As they deregulate and suddenly have 50 players in the whole area rather than one or two players in each separate area, it becomes more obvious that nobody has any particular value added over anyone else, which is driving everyone to try and create competitive advantage." To get that advantage, Scott Russell, deputy general manager of the information technology department at Tokyo-based S.G. Warburg Securities, confirms that "Japanese banks are pouring incredible amounts of money into technology."

Yuji Ogino, president of IDC Japan Ltd., expects overall IT purchases in Japan to grow about 12% in

What's Hot in Japan

Top Japanese PC suppliers

	1989 RANK	COMPANY	PC REV.	IS REV.
1	3	NEC	3,116.5	11,480.4
2	13	Toshiba	1,340.8	4,595.1
3	4	Fujitsu	869.7	11,378.9
4	6	Hitachi	652.3	8,719.0
5	40	Seiko Epson	579.8	1,449.5

Top Japanese service suppliers

	1989 RANK	COMPANY	SERVICE REV.	IS REV.
1	24	NTT	898.7	2,254.0
2	3	NEC	289.9	11,480.4
3	4	Fujitsu	253.7	11,378.9
4	6	Hitachi	181.2	8,719.0
5	42	C. Itoh	108.7	1,345.9

Revenue figures are in millions of dollars.

1990, with hardware-only revenues up 13% and software-only revenues up 15%. Systems integration revenues will be the star, he says, growing at more than 30%, which should result in a ¥1.2 trillion market by 1992. Of total IT expenditures, office automation systems and telecommunications figure most prominently. An annual forecast of the country's leading goods and services by the daily *Keizai Shinbun* projects that PCs will be second only to credit cards in 1990, growing at 12%. Optical fiber rates fourth or fifth, with a growth rate of 7%.

The Ups and Downs in Asia

The companies that grew the most in 1989

	1989 RANK	COMPANY	1989 IS REVENUE	1988 IS REVENUE	% INCREASE
1	97	Kyocera	366.4	258.5	41.7%
2	24	NTT	2,254.0	1,694.0	33.1%
3	75	Acer	493.7	379.4	30.1%
4	94	Mitac	380.0	293.3	29.6%

The companies that couldn't keep up in 1989

	1989 RANK	COMPANY	1989 IS REVENUE	1988 IS REVENUE	% DECREASE
1	86	Alps	420.4	526.7	(20.2)%
2	40	Seiko Epson	1,449.5	1,487.7	(2.6)%
3	107	Intec	321.8	326.0	(1.3)%

Revenue figures are in millions of dollars.

"In Japan you've got people carrying notebooks [computers], people carrying a portable telephone, people having a nonportable phone on the train, fax machines in cars," says Baring Securities' Johnson. "Communications in Japan is becoming multidimensional and omnipresent, and though it's not bottlenecked necessarily, it's very stretched."

The projected rate of growth in fiber optics is thus no surprise, as Nippon Telegraph and Telephone Corp. has targeted 40% of its domestic switching systems to be digitized this year. A trans-Pacific fiber optic cable is also on schedule.

While not plagued by a labor shortage as Japan is, South Korea and Taiwan have seen their labor costs and currency valuations skyrocket in the last few years. Over the last three years, real labor costs in South Korea have gone up around 200%. Between September 1986 and December 1989, the cost of labor in Taiwan rose approximately 150%, and the new Taiwan dollar (NTD) appreciated about 45%. Although South Korea's export-driven economy has been slumping since last year, neither country's economy seems threatened with disaster.

South Korea's market for IT is, for instance, still second only to Japan's. Tony Tsang, a general manager for Wang Pacific Ltd., says: "Three years ago, we [at Wang] bought out our Korean distributor because the market was just getting too big for a distributor to handle. South Korea is becoming the second-largest market—$1.5 billion in 1989 and well on its way to $2 billion."

Says Sung Kyou Park, president of Daewoo Telecom Co. Ltd. of Seoul, "We may not see very high-paced growth, but the economy will grow, and of course [there are] some problems to solve. Traditionally, people looked upon this part of the world as the area where the economy was growing due to inexpensive labor. But the labor cost in this part of the world has gone up very, very fast, especially in South Korea.

"In order to absorb that kind of expensive labor cost, we have to go through many structural changes," Park says. "We have to develop different types of products that have more value added so we can be competitive in the world market."

No doubt due in part to the uncertainty surrounding such change, South Korea's stock index has fallen by about 10% so far this year and has stood at its lowest level since the start of last year. But most analysts expect South Korea's growth to accelerate in the second half of the year.

Taiwan's economy is in much the same position as South Korea's, save for a lower concentration of heavy industry. IT already figures prominently in the continued growth of the domestic economy, which is also being forced by high labor costs to shift to more value-added products, such as software, that are sold under brand names, not via original equipment manufacturer (OEM) channels. The Taipei-based Institute for Information Industry (III) says its IT industry, including software, should reach $7.5 billion in 1990. "Even though Taiwan is very important to the world information industry, there is not much brand name recognition. We have to promote brand names aggressively. Also, to compete with Korean companies, we have to create [more] value-added products," says Max Wu, vice president of market promotion for Acer.

Developing markets for those products is a top priority for both countries. Daewoo has set up a European marketing network. The Soviet Union and Eastern Europe also represent important potential business for Korean and other East Asian IT suppliers. East Asian suppliers finalizing deals for supply or assembly of PCs in those regions include South Korea's Lucky Goldstar, Singapore's Wearnes Technology and Malaysia's Accent Technology SB (ATSB). Paul Liu, president of Taiwanese laptop maker Aquarius Systems, says 20% of its anticipated 1990 sales of $30 million will be to Eastern Europe. Acer seems to have successfully globalized its operations. One of the top three suppliers in over 15 countries, Acer says it is No. 1 in Bahrain, Bolivia, Chile, Cyprus, Jordan, Taiwan and Thailand.

OEM, not brand name, business continues to be

Taiwan's bread and butter, despite the increases in labor costs. "Everyone said that after the Taiwan dollar was appreciated 45% and the labor costs here went up 150%, the buyers would start going to mainland China, Indonesia and all that. Well, some did, but instability and unreliable supplies just drew all the buyers right back to Taiwan. Overall, Taiwan's exports have continued to grow at 20 to 30%," says David Lightle, consultant to the Brand International Promotion Association (BIPA) in Taipei.

The Taiwanese software industry is, however, not yet mature enough to start exporting its product; III says the industry will have to wait until the copyright law changes before it can export. In the meantime, says BIPA's Lightle, "Taiwan has been contracted to do a lot of [OEM] software development for IBM. That's a major, major project, hundreds of millions of dollars for IBM Taiwan."

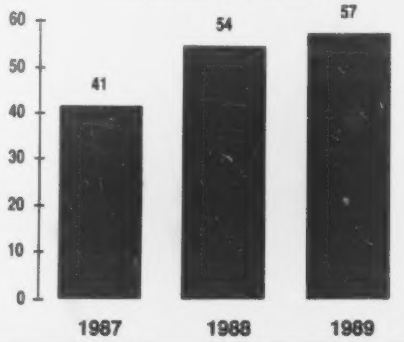
Whether its IT industry continues to be OEM or becomes predominantly brand name, one of Taiwan's greatest strengths is its engineering and sheer brain power, says Jackson Lin, general manager of Wang Industrial Co. Ltd. in Taipei. Furthermore, says Lightle, the historical drain on that resource is reversing. "Salaries are up into the $50,000-a-year range for top flight engineers, so more are saying, 'Why should I think about getting a better life in San Francisco when I can come back home?' And companies like Acer are snapping them up," he says. "Brain drain is not a problem for Taiwan anymore; they're getting enough back now to support the boom in high tech. It's Hong Kong that is losing everybody."

Hong Kong's Growth Is Slowing

An emigration of talented IS pros from the Fragrant Harbor has been one dear price Hong Kong has paid for Britain's decision to give it back to China in 1997. Its economy also has suffered from the events of last June in Beijing. Before Tiananmen, Hong Kong's trade with China was growing at an annual rate of 35%; it fell to 3% for the third quarter of 1989. Analysts expect Hong Kong's gross domestic product growth rate to slow to around 2.5% this year, in large part because the regime in Beijing slammed on the brakes of political and economic reform. Growth should not drop below that, as government projects already under way and the commitment of long-time Hong Kong corporations to stay should keep the demand for information systems strong.

Asia Surges

Total IS sales for DTM 100 Asian companies ($ billions)



A 1989 member survey by the Hong Kong Computer Society found that over 40% of the top IS professionals intended to leave the territory within the next 18 months for Canada or Australia or the United States. "What's happening is you're having middle management, the 30- to 35-year-old experienced guys, migrating to Canada, Australia, switching their passports," says Graham Glover, area head of the information systems division for Standard Chartered Bank. "They're the ones that really hurt when they go because these are the guys that you're reliant upon, who understand how the organization works." Surprisingly, Standard Chartered had less staff turnover in 1989 than in 1988, with about 30% turnover in 1988 and 15% last year.

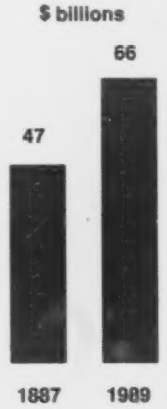
Says Software Vision's Rafael, "Clearly, that has an effect on the information technology industry. The dependence that companies had before on in-house expertise doesn't exist. There is no in-house expertise." As a result, IT suppliers will have to provide systems expertise for the government's infrastructure projects, namely the HK$127 billion new Chek Lap Kok Airport and a new port. The government may also choose to implement an EDI system for trading, called Tradelink, by 1991.

"The Hong Kong government has been sharply increasing its IT spending, upgrading the DP agency to a full department status," says Wang's Tsang. "The increase in its staff is close to a tripling since the current director took over. Various things have led to it: partly 1997; next year will be another 10-year census; and also the first large scale, direct election of the city council. The labor problem [shortage] has created a keener sense of automating."

Some corporations, such as Standard Charter, are following the government's lead. "We, in IT terms, are putting most of our efforts into Hong Kong. Not all projects have been developed in Hong Kong, but by far the majority of them," Glover says.

Veterans like A.F.M. "Con" Conway, director, major accounts group, at Hong Kong Telecommunications Ltd., who has been in the Hong Kong IT industry for nearly 30 years, see no reason for concern. "In Hong Kong, we're a very large user of information technology . . . [and] it will continue to increase—I would see a 10% compound—provided we get the various issues correct."

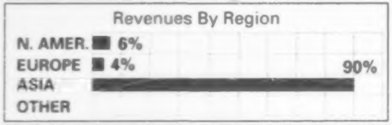
One of those issues, he says, is getting the regulations of the Coordinating Committee for Multilateral Export Controls (CoCom) changed to accommodate Hong Kong in 1997. "The situation arises that on Tuesday, the 1st of July, 1997, we're technically part of China and not part of Britain. Therefore, all goods being shipped into Hong Kong will be shipped as if they were shipped to China. The vast majority of goods on that list would not get a license for China, [but] all of these products could come into Hong Kong without a matter of hindrance at the moment," Conway says. ▭



Asia spent $66 billion on IS in 1989, up 40% from 1987.

IS Revenues: $11.48 Billion

REGION 1 **NEC** WORLD 3



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In 1989, NEC Corp. recognized that the market in Japan for intelligent buildings (IB), which sport integrated information systems (IS) facilities, is an excellent way to leverage its expertise in computers and communications (C&C). To better serve the ¥200 billion ($1.5 billion) market that is growing at 20% per annum, NEC upgraded its section devoted to IB engineering to a division, called the C&C Intelligent Building Systems Division. As of July 1989, NEC's share of the market was 15%, which the company hopes to boost to 20% by mid-1992.

Pioneering new markets is important for NEC. Its IS revenues for the period between September 1988 and September 1989 were ¥1.58 trillion ($11.5 billion) or nearly 50% of total sales, and represented an 18% gain over calendar year 1988 figures. NEC's net income was down marginally to ¥71.6 billion ($518.9 million).

Supercomputing is not a new market for NEC, but the company is busy trying to increase its market share in the United States and Europe, selling the new SX-3 through both direct and local sales subsidiaries. In the United States, NEC is marketing the SX-3 through its sales subsidiary, HNSX Supercomputers Inc. The SX-3 series should be available on the U.S. market sometime between July and September of this year. NEC says it hopes to avoid trade friction with Washington by concentrating supercomputer sales in the private sector.

NEC made new mainframe and midrange product introductions in 1989 to reinforce and expand its market share. The ACOS mainframe line acquired a new midrange model, the ACOS 3400, running at between 1.3 and 9.3 million instructions per second. Meanwhile, sales of the smaller ACOS 3300 (0.5 to 2.3MIPS) series continues to be strong; a total of 2,000 were sold in Japan and overseas between its introduction in late 1987 and September 1989. As part of its ongoing, heated competition with Fujitsu Ltd. and others in the Japanese small-business computer (SBC) market, the company introduced a 32-bit laptop model of its 3100 series of SBCs.

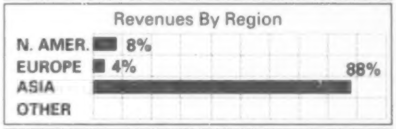
Meanwhile, at the other end of the market, NEC unveiled in October a notebook-sized personal computer which is 1.7 inches thick and weighs in at 6 pounds. This PC-9801N is marketed as the 98 Note. The popularity of notebook computers among Japan's users, particularly in finance, contributed to the company shipping 20,000 units in December alone. The 98 Note is compatible with NEC's PC-9800 series of PCs for which 4,800 application software packages are available. Overseas, NEC unveiled a similar unit, the Ultralite, which is a scant 1.1 inches thick and weighs 4.4 pounds. The difference is that the Ultralite uses integrated circuit cards rather than floppy disks.

Another attempt to increase market share last year, this time in the exploding local government IS market, put NEC smack in the middle of the "¥1 discount" scandal. The incident caused NEC, as well as Fujitsu, to come under harsh criticism for locking out competitors and denigrating the value of software development by submitting below-cost ¥1 bids for two local government computer system design contracts. Both companies have promised not to do so again, but the high-growth potential of the local government market will keep it a tempting target for undercutting the competition.

—Steve McClure

IS Revenues: $11.38 Billion

REGION 2 **FUJITSU** WORLD 4



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For Fujitsu Ltd., Japan's biggest computer maker, 1989 was the Year of FM Towns, its new 80386-based 32-bit personal computer. Fujitsu sees FM Towns, which uses a compact disc read only memory (CD-ROM) drive, sports arcade caliber graphics and impressive sound, as the centerpiece of its challenge to NEC Corp.'s dominance of the Japanese PC market. However, despite the company's high hopes for FM Towns, the PC has received less than rave reviews, which did not measure up to Fujitsu's expectations.

The marketing strategy for FM Towns had several problems. One may have been trying to market it initially as a home computer. Although it sells for less than ¥400,000 ($2,900), most Japanese consumers consider that a lot of money, not to mention a lot of computer, for a home PC used for video games and typically simple home applications. Later in the year, Fujitsu seemed to change its mind about the best market for FM Towns, reorienting its campaign toward businesses.

NEC looks to increase its market share in supercomputing.

Another problem seemed to be a lack of CD-ROM-based software, particularly for business use. The company admits that the slower than anticipated pace of CD-ROM software development hindered sales. Indeed, at about 5,000 units a month, early sales lagged far behind initial projections of 7,700 units a month through March 1990. The company says that at a Fujitsu product showcase in the latter half of the year, it demonstrated to customers a considerably larger repertoire of business software. This may have helped sales, which, Fujitsu claims, picked up toward the end of 1989.

Sales of FM Towns in both markets must continue to increase if Fujitsu is to reach its goal of capturing 30% of Japan's PC market over the next three years. The firm now has just over 13% of that market on a production-volume basis.

Despite initially slow sales for FM Towns, overall information systems revenues for Fujitsu, for the period between

September 1988 and September 1989, grew to ¥1.6 trillion ($11.4 billion), about 11.4% higher than calendar 1988 sales.

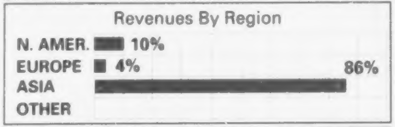
Other PC news for Fujitsu in 1989 includes its purchase of a 38% stake in Sunnyvale, Calif.-based Poqet Computer Corp. and the introduction of its first color laptop, the 32-bit FMR-50LX6. The deal was designed to help Poqet market its PQ/XT, a pocket-sized IBM-compatible PC that operates on two dry cell batteries for more than 100 hours. It is scheduled to go on sale in autumn of 1990.

In the Japanese mainframe market, Fujitsu held on to its lead, with a 32% share in terms of units sold. In June, eight months after Fujitsu paid IBM $833 million to settle their software copyright dispute, the Japanese computer giant introduced MSP-EX, a new operating system, which Fujitsu says boosts compatibility between its mainframes and IBM's. The system is capable of 1 million transactions per hour, 10 times faster than previous Fujitsu operating systems. In September, Fujitsu announced it will export MSP-EX to West Germany's Siemens AG on an original equipment manufacturer (OEM) basis, in what it says is a first for a Japanese computer company.

Fujitsu, along with rival NEC, found itself in hot water last summer when it submitted preemptive ¥1 bids for two local government computer system design contracts. Both companies withdrew the bids after the Japanese Fair Trade Commission warned that such practices could be punishable under the Anti-Monopoly Law—but not before after they had received a lot of bad press. *—Steve McClure*

IS Revenues: $8.72 Billion

REGION 3 **HITACHI** WORLD 6



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Hitachi Ltd. continued to concentrate on the domestic information systems market in 1989 in its ongoing effort to counteract the effects of the strong yen. The company also took strides to keep up with other Japanese IS firms making aggressive moves to enhance long-term prospects overseas. Hitachi's overall sales between September 1988 and September 1989 rose 13% over calendar year 1988 figures to ¥6.8 trillion ($49.1 billion). Computers led that growth, with sales for the year ending September 1989 reaching ¥1.2 trillion ($8.7 billion), up about 13.8% over calendar 1988's computer sales.

Hitachi's increased attention to the midrange and workstation arena paid off, reaping sales of ¥75 billion ($544 million). The major customers that have been the key to this growth are banks, financial firms and securities companies. Hitachi sees great growth potential in the manufacturing and distribution industries, as more Japanese companies in those sectors computerize their operations. In order to meet what it expects to be an increase in demand for workstations, Hitachi last summer unveiled new 16-bit and 32-bit models in its 2020 and 2050 series.

To boost demand for supercomputers and to offset criticism that Japanese computer makers offer academic institutions unreasonably big discounts for supercomputer rentals, Hitachi reduced rental charges to all of its customers on all four models of its HITAC S-820 supercomputer series by 25 to 35% in September. With an eye to its future in supercomputing, Hitachi developed an experimental superconductive supercomputer in 1989. The experimental unit features Josephson Junction processors and can carry out 250 million operations per second.

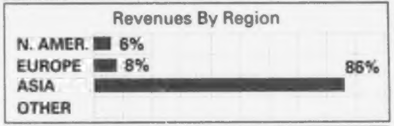
Overseas moves for Hitachi last year included its $398 million April purchase, in cooperation with Electronic Data Systems Corp. (EDS), of National Advanced Systems Inc. (NAS), the mainframe subsidiary of National Semiconductor Corp. NAS became Hitachi Data Systems Corp., with the Japanese firm holding an 80% share. The move was hailed as a bold one and has two key advantages, according to Hitachi. It ensures that NAS will continue to remarket Hitachi IBM-compatible mainframes and memory devices in the United States and Europe, and the link with EDS should strengthen Hitachi's hand in software development.

In Europe, where its IS sales remain weak, Hitachi announced that Hitachi Semiconductor (Europe) GmbH, established in 1980, will begin integrated production of semiconductors in 1992 in Landshut, West Germany. Work on the Landshut plant is set to begin this spring. In anticipation of increased business in Eastern Europe, Hitachi has set up a section in its international division to deal exclusively with that part of the world.

Meanwhile, Hitachi Europe's research and development division established two laboratories in 1989. One, in Cambridge, England, will conduct microelectronics research, whereas the other, in Dublin, will engage in information science research. Hitachi also established its first labs in the United States—one in San Francisco for semiconductor-related R&D and the other in Detroit for auto industry-related research. *—Steve McClure*

IS Revenues: $4.6 Billion

REGION 4 **TOSHIBA** WORLD 13



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Last year, Toshiba Corp. took Japan's laptop market by storm with Dynabook, which weighs just under 6 pounds, and at ¥190,000 ($1,375), costs less than half the price of Seiko Epson Corp.'s similar model. Just over six months after its July launch, Dynabook surpassed its annual sales target of 60,000 units, and Toshiba is now confident of selling another 60,000 by this summer. Seven months after its launch, Toshiba introduced six new Dynabook versions, one of which includes a hard disk. "Dynabook brought computers within the reach even of university students," says Shigenori Matsushita of Toshiba's Information Processing Group. He adds: "Our product actually helped expand Japan's PC market as a whole."

Despite a rapid 20% annual growth, Japan's PC market is less than one-tenth the size of the U.S. market. Even at Toshiba's central Tokyo office, there is only one PC unit for every two or three employees. Indeed, keyboards are still alien to most Japanese, who have been brought up on brush and ink rather than typewriters; many middle-aged Japanese have never touched a keyboard of any kind. "It mainly stems from our cultural tradition," explains Matsushita. "But it means that there is room for growth [in PC use]."

Internationally, Toshiba has a reputation for laptop computers, but those sales constitute merely 30% of the company's total information systems revenues. The overwhelming majority of sales is generated by midrange computers, workstations and peripherals—with the midrange remaining the core of Toshiba's domestic computer business. Toshiba does not produce mainframe computers, but is beginning to succeed in muscling into this market with a system that combines sophisticated midrange computers and microcomputers. "The traditional computer system in major corporations of a big host computer and dozens of dumb terminals has proven to be highly inefficient," explains Matsushita. Over the past 10 years, Toshiba has been developing decentralized systems using midrange computers, sales of which Matsushita expects to increase by 12% this year

Toshiba's IS revenues were ¥634 billion ($4.6 billion) for the period from September 1988 to September 1989, with net income at ¥129 billion ($935 million).

Over 100 hotels in Japan, including those owned by the fast-growing All Nippon Airways—Japan's No.2 carrier—have so far installed Toshiba's midrange systems. Hospitals are another area of Toshiba's strength for these systems. However, these sales successes have so far been limited to the domestic market, unlike Toshiba's success with its laptop products. "You have to develop close relations with your clients—something that's very difficult to do in foreign markets," says Matsushita. "In the PC markets, it's a different matter altogether; the products sell themselves." That Toshiba was quick off the mark in tapping into huge overseas PC markets also contributed to its success there.

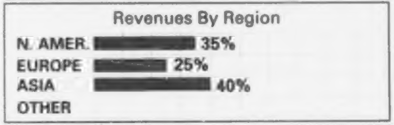
Toshiba's best-selling laptops—the 3100, 2100 and 1100 series—were all launched first overseas, and the company now commands a 48% share in Europe and a 28% share in the United States. In 1987, Toshiba opened a U.S. manufacturing base in Irvine, Calif., which has an annual output of 15,000 units. Toshiba's West German plant was scheduled to begin operations this past April, producing 5,000 units annually. Most components for both: plants are supplied locally, with the exception of flat displays, keyboards, floppy disks and large scale integrated circuits. "These are the components which have to be shipped directly from Japan to ensure high quality," says Matsushita.

Via a recent original equipment manufacturer (OEM) agreement with Sun Microsystems Inc., Toshiba is also intent on expanding its share of Japan's workstation market. "We mean to be No.1 in every area of our computer business," Matsushita concludes confidently.

—Nobuko Hara

IS Revenues: $3.78 Billion

REGION		WORLD
5	**CANON**	14



CANON INC.

Shinjuku Daiichi Seimei Building
7-1 Nishi-shinjuku 2-chome
Shinjuku-ku, Tokyo 163, Japan
(81-3)-348-2121

Peripherals brightened up an otherwise dull year at Canon Inc., as sales of laser printers and facsimile machines boosted information systems revenues for the 12 months ended in September 1989 by a robust 20% over calender 1988 figures up to ¥522 billion ($3.8 billion). Indeed, sales of peripherals alone, primarily laser printers, increased 52% to ¥270 billion ($2 billion). The company's overall sales rose 18% to ¥1.3 trillion ($9.8 billion), but net income stayed almost the same as that for the 1988 calendar year, at ¥38.2 billion ($276.9 million).

Canon, one of the most aggressive seekers of business around, has continued to increase its activities overseas, with a 74% export ratio, 63% of which is denominated in U.S. dollars. In the first half of the year, the firm concluded its contracts at a rate of ¥127 to the dollar, but with the yen dropping below 150 to the dollar, Canon's earnings picture will likely change radically for the better.

Canon's dominance of the laser printer field continues unchallenged. The firm has 70% of the domestic laser printer market and 80% of the overseas market. In March of 1989, the company announced plans to build a factory in Britain within the next two years to produce laser printers and fax machines.

Canon's strength in peripherals contrasts with its continued weak showing in the rest of the Japanese IS market, where analysts say the company's future remains very much in doubt. In an effort to get a leg up in the computer field, Canon paid $100 million in June for one-sixth of Steve Jobs' Next Inc. and exclusive marketing rights in Asia for the Next machine. While some observers see Canon's move as an attempt to develop its own computer business, the firm says the deal represents merely an ideal hardware/software combination. Canon has set up its own software development group and expects to have Japanese software ready for the Next computer by this summer. The Next machine uses Canon's 5¼-inch erasable optical disk, which has 256 megabytes of memory. Analysts say the disks are likely to become a major product line for Canon, and one estimate is that they will earn the company more than ¥100 billion ($725 million) by 1995.

Whether that can be realized depends on whether Canon learned from its failures in marketing Apple Computer Inc.'s systems in Japan in the mid-1980s. Having little experience in marketing integrated information systems, Canon failed to provide adequate maintenance for both hardware and software. Now, the company plans to focus on supporting Next systems in this effort.

Matsushita steps up to the world stage with PCs and workstations.

Meanwhile, Canon found itself in hot water with Japan's Fair Trade Commission (FTC) in October. The FTC raided 39 Canon sales offices in search of evidence that the company had been trying to keep prices of Apple computers high by shutting out of the market those distributors that were undercutting Canon's Apple prices. Reports said that Canon had pressured magazines not to take advertisements from such companies. The FTC has yet to file its report, but skeptical observ-

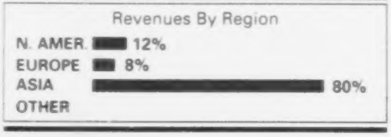
THE DATAMATION 100

ers note that while Japanese law can order companies to halt such practices, the FTC does not have the power to impose fines or other forms of punishment.

In management, Canon had one major change in 1989. Executive vice president Keizo Yamaji took over Canon's presidency in February, while Ryuzaburo Kaku moved from the presidency to the chairmanship. —*Steve McClure*

IS Revenues: $3.66 Billion

REGION		WORLD
6	MATSUSHITA	15



MATSUSHITA ELECTRIC INDUSTRIAL CO. LTD.
1006 Oazakadoma
Kadoma-shi, Osaka-fu 571, Japan
(81-6)-908-1121

Matsushita Electric Industrial Co. Ltd. successfully continued its increased emphasis on information systems last year. While many areas of Japan's

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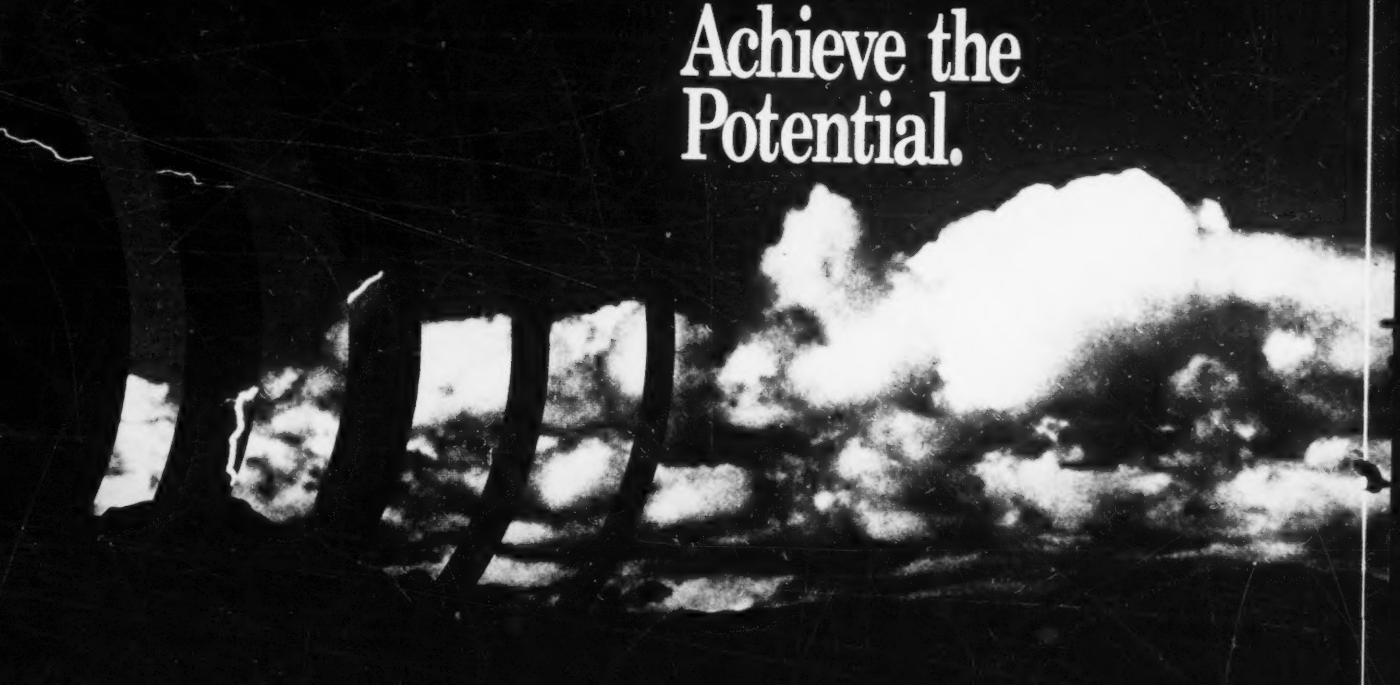
consumer electronics market approach saturation, Matsushita's IS division is prospering, once more leading other company sectors in growth. For the year ending September 1989, the IS division had revenues of ¥506 billion ($3.7 billion), up 15% over calendar 1988 figures. Meanwhile, the firm's overall revenues rose 9.4% to ¥5.6 trillion ($40.9 billion).

Whether Matsushita will ultimately join the ranks of Fujitsu Ltd. and NEC Corp. in the IS business remains to be seen. Realizing it cannot hope to introduce an entire range of systems in one fell swoop, the company has chosen to concentrate its efforts on PCs and workstations, areas that seem to have the greatest potential. Having abandoned the mainframe field in 1964, Matsushita has no plans to reenter that arena.

In October, Matsushita introduced to the domestic market the first model in its UNIX-based 32-bit BE office workstation series, which it hopes will capture a good share of Japan's growing office automation market. Last year, Matsushita also shifted production of its 32-bit engineering workstations to the United States. The workstations are designed by Longmont, Colo.-based Solbourne Com-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puter Inc., of which Matsushita is part owner.

Matsushita resumed exports of PCs to Europe and North America last fall for the first time since 1987, in the wake of with the resolution of a copyright dispute with IBM which had forced it to halt overseas PC shipments. Matsushita is now making 8-, 16- and 32-bit IBM-compatible laptops in Japan to be sold in Europe under the Panasonic brand name, while Tandy Corp. is making 16- and 32-bit models in the United States on an original equipment manufacturing (OEM) basis. Similarly, Fujitsu last year began supplying Matsushita with its 32-bit FM Towns PC on an OEM basis for the Japanese domestic market.

To help make inroads into the PC market, where it is still an also-ran, Matsushita last year set up the Matsushita Computer Co. (MAC) in Tokyo to specialize in workstation sales, support and systems integration. In a departure from standard Japanese corporate practice, Matsushita has lured experienced personnel away from other companies rather than staffing MAC with Matsushita employees. Although MAC will be headed by Matsushita managing director Shigeuki Nishiuma, it will have considerable autonomy in day-to-day operations.

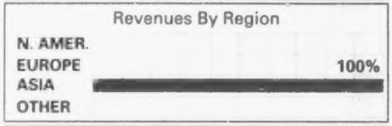
President of Nihon Unisys, Mr. Koichiro Nishikawa.

Although Matsushita lost its founder, Konosuke Matsushita, in April 1989 at the age of 94, the company has gone on with little change. In March of last year, Richard Kraft, a 15-year veteran of Matsushita's U.S. operations, was appointed to the post of president and chief operating officer, succeeding Akiya Imura. As the first American to occupy the position, he may help Matsushita deal more effectively with U.S. concerns about Japanese trade and investment policies in the United States.

—*Steve McClure*

IS Revenues: $2.25 Billion

REGION		WORLD
7	NTT	24



NTT DATA COMMUNICATIONS SYSTEMS CORP.

17 Mori Building
26-5 Toranomon 1-chome
Minato-ku, Tokyo 105, Japan
(81-3)-509-4647

While its parent company, Nippon Telegraph and Telephone Corp. (NTT), flounders as the result of the arrest of three former executives for bribery and the prospect of being broken up into smaller companies, NTT Data Communications Systems Corp. continues to do well.

Since being spun off from NTT in May of 1988, NTT Data has taken the lead in Japan's annual ¥348 billion ($2.5 billion) systems integration market, which is a growing at a rate of some 32% per year. Because it is the only company in Japan that handles all aspects of systems integration—designing, installing, operating and maintaining information systems—NTT Data looks well positioned to maintain its No.1 spot.

In its first (partial) year of operations, from May 1988 to March 31, 1989, NTT Data registered a net loss of ¥7.6 billion ($59 million) on sales of ¥228 billion ($1.8 billion) because of a one-time transfer of retirement benefits from NTT. But for the year that ended September 30, 1989, the company recorded a net income of ¥3.2 billion ($23.5 million) on sales of ¥311 billion ($225 billion). NTT still owns 100% of NTT Data, but if the

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subsidiary continues registering a solid business performance, its shares should be listed publicly in 1992.

Large public and financial concerns account for 80% of NTT Data's sales, but the firm is targeting smaller companies, especially in the manufacturing field, in the belief that their demand for systems integration will grow. Analysts say NTT Data's ability to market its services is the key to its future.

In response to Japan's shortage of software engineers, NTT Data last year set up software development offices in Japanese regional centers such as Nagoya, Osaka and Sapporo. Each office will be staffed with about 10 software specialists assigned by the Tokyo headquarters; NTT Data's goal is to have at least 100 employees at each office.

One of NTT Data's biggest projects in 1989 was designing a system using Hitachi Ltd. mainframes and Fujitsu Ltd. terminals for the Tokyo International Financial Futures Exchange, which began operations in June. Another highlight of 1989 was the increased use of NTT Data's Automatic Answer Network for Electronic Request (ANSER) system, through which bank customers can gain access to information concerning their accounts by using fax machines, PCs, telephones or dedicated home use terminals. The nationwide ANSER network now handles 25 million calls a month.

—Steve McClure

IS Revenues: $2.11 Billion

REGION		WORLD
8	NIHON UNISYS	25

Revenues By Region

N. AMER.	
EUROPE	
ASIA	100%
OTHER	

NIHON UNISYS LTD.
17-51 Akasaka 2-chome
Minato-ku, Tokyo 107, Japan
(81-3)-585-4111

In the face of stagnating growth in Japan's mainframe computer market, Nihon Unisys Ltd. recorded a healthy 11% growth in revenues to ¥291.5 billion ($2.1 billion) last year. "We are happy with last year's results," says Hiroshi Yoshida, Nihon Unisys' director of corporate communications. Much of the growth resulted from the sale of the company's new 2200-600 midrange series. New 2200-600s were installed at Japan's second largest airline, All Nippon Airways (ANA), in a multibillion-yen sale; at Japan's two leading car manufacturing firms, Toyota Motor Corp. and Nissan Motor Co. Ltd.; and also in Yamaichi Securities, one of Japan's four major brokerage houses. The ANA deal was the culmination of several years that Nihon Unisys spent developing a new computerized reservation system for the carrier and represented its biggest sale in 1989.

Currently, Nihon Unisys imports half its products from the United States, with the rest manufactured by Japanese companies such as Oki Electric Industry Co. Ltd.—a minority shareholder. However, prompted by problems in production of the 2200-400 series, management is increasing domestic production to ensure faster delivery and higher quality. The series, launched in March 1988, was not delivered until April 1989 due to production delays in the United States—the sort of problem for which Japanese clients have little patience. "Luckily, we didn't have any cancellation of local orders [as a result]," says Yoshida. Oki began producing the computer last June, and today 40 units roll off Oki's production line every month. Management asserts that the output is likely to increase this year because the United States still has a backlog of orders.

Despite its expertise in mainframe technology, Nihon Unisys is painfully aware of its shortcomings in the PC market, which is expanding by more than 20% annually. But a PC sold by a U.S. counterpart, lacking any Japanese language capability, is of no help. Currently, Nihon Unisys is forced to sell Toshiba Corp.'s J-3100 to its clients who insist on a completely networked PC system. The UP10 PC, jointly developed with Sanyo Electric Co. several years ago, has long since become obsolete. In any case, Japan's complex distribution system means that a huge initial investment would be necessary for Unisys to break into the PC market—and it is probably too late to start completely from scratch. "Our only way would be to tie up with a company like Seiko Epson, which is strong in PCs

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but lacks what we've got," Yoshida points out.

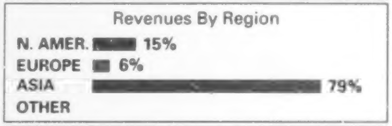
In the Japanese mainframe market, too, competition is intensifying. But Nihon Unisys has an unshakable reputation for excellent system engineering, a reputation that was confirmed yet again last year when Japan's best-selling computer monthly, *Nikkei Computers*, gave it the top rating. "We are not in competition for hardware anymore. What clients are looking for now is personalized services and design capabilities," Yoshida says.

—Nobuko Hara

IS Revenues: $2.03 Billion

REGION		WORLD
9	MITSUBISHI	29

Revenues By Region



MITSUBISHI ELECTRIC CORP.

2-3 Marunouchi 2-chome
Chiyoda-ku, Tokyo 100, Japan
(81-3)-218-2111

In 1989, Mitsubishi Electric Corp. continued its steps to offset the appreciation of the yen, streamlining operations and product development, boosting overseas procurement and transplanting production into other countries. Exemplary of the trend was the establishment on January 1, 1989, of Mitsubishi Electric France SA, a $3 million wholly owned subsidiary headquartered in Paris. The company's first product, which will be manufactured in Entrelles, France, will be cellular mobile telephones.

These moves may have been responsible for Mitsubishi's strong information systems sales across the board. Despite a softening of the dynamic random access memory (DRAM) market, IS sales for the year ending in September 1989 increased 6% over calendar 1988 figures, reaching ¥279.5 billion ($2 billion). Total corporate revenues were ¥2.9 trillion ($21 billion). Net income, including that for IS, grew to ¥67.4 billion ($488.5 million), a 97% rise from 1988.

Within the company's information-processing systems business, which ranges from PCs to general purpose mainframes, sales for mainframes were not as successful last year as had been hoped. Mitsubishi had pushed to reestablish itself in the mainframe market by introducing the new Cosmos and EX series models, but due largely to inadequate applications and operating system software, the attempt fell short of the mark. According to a report from Tokyo-based S.G. Warburg Securities (Japan) Inc., the company had sold 57 Cosmos and 48 EX series models as of September 1989, about 40% fewer than projected.

Also in 1989, Mitsubishi introduced an upgraded version of its 16-bit EX series office computers, the 32-bit Gureo line, which is packaged with a high-speed relational database management system. Sales for the system were slow, but Mitsubishi fared better with its Maxy series of 16- and 32-bit desktop and laptop PCs, which also came on line last year.

Improvements in disk drives continued with the October 1989 introduction of an erasable optical magnetic disk drive. Innovations in peripherals included digitally operated color printers capable of reproducing 16.7 million colors for design and publishing applications.

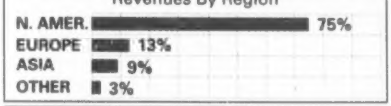
Mitsubishi's strength in the semiconductor and defense electronics business also continued. As a major DRAM supplier, the company sold ¥376 billion ($2.7 billion) worth of semiconductors last year, a 42% increase.

—Peggy Trautman

IS Revenues: $1.95 Billion

REGION		WORLD
10	OKI	30

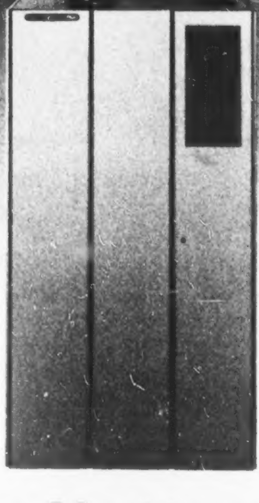
Revenues By Region



OKI ELECTRIC INDUSTRY CO. LTD.

7-12 Toranomon 1-chome
Minato-ku, Tokyo 105, Japan
(81-3)-501-3111

Oki Electric Industry Co. Ltd. recorded a handsome 19% increase in its information systems revenue, to ¥269.3 billion ($1.95 billion) for the year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ending September 1989, due mainly to its expanding business in Japan's fast-growing financial industry. The banking and securities industry, the moneybags of the Japanese economy, traditionally has been Oki's main area of strength. The location of Oki's headquarters—in a Fuji Bank Ltd. building—symbolically underscores the strength and influence wielded by the firm's major shareholder. "The finance industry is our biggest source of IS revenues," confirms Masayoshi Yurugi, general manager of Oki's Information Systems Group.

Japan's highly profitable commercial banks, with huge nationwide branch networks, are constantly updating their computer systems and automated teller machines (ATMs). "Now they are in the middle of developing a fourth-generation on-line system," says Yurugi, and Oki plays a significant role in that development. Further deregulation of Tokyo financial markets—particularly retail banking—should result in more business for Oki, as banks, as well as securities and insurance companies, are likely to increase investments in computer systems and high-speed ATMs to face intensifying competition.

Although it manufactures Nihon Unisys Ltd.'s 2200-600 and -400 models, Oki does not produce mainframe computers. However, the firm has strong expertise in decentralized, midrange information systems. Fuji Bank, for instance, has installed Oki's systems at more than 300 of its retail branches throughout Japan. "It is no exaggeration to say that we could start a bank anytime. We may have more expertise in running a financial outlet than most bankers," says Yurugi. A good grasp of the financial business helps Oki win clients' confidence and design the system that best suits their needs. Applications, Yurugi emphasizes, are the key to the computer business today.

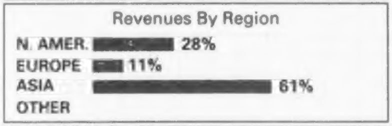
In the same market, sales of Oki's new, high-speed ATMs are skyrocketing; the company expects at least 10,000 units to be shipped this year. "We can't meet the demand," Yurugi says. Through an original equipment manufacturer (OEM) agreement with Sun Microsystems Inc. signed last May, Oki hopes to have access to some of Sun's wealth of financial software, which can be modified for the company's financial clients.

Oki is not a weakling in the laptop market, although it focuses its efforts on a higher income market sector than its competitors. The company has a magazine-sized laptop and plans to launch its sophisticated 32-bit model, the AX 30, by this summer. Aimed at corporate clients, the new laptop could be 50% more expensive than Toshiba Corp.'s 16-bit models. "We don't bother with massive [advertisements] because our clients are major corporations. Our products rarely appear at discount stores for this reason," concludes Yurugi. Indeed, that may well be Oki's major strength.

—Nobuko Hara

IS Revenues: $1.80 Billion

REGION **11** **RICOH** WORLD **33**



RICOH CO. LTD.

15-5 Minami-Aoyama 1-chome
Minato-ku, Tokyo 107, Japan
(81-3)-479-3111

Although in recent years Ricoh Co. Ltd.'s earnings have suffered from the effects of the high yen and trade friction, these factors were not in evidence in 1989. Ricoh's overall sales rose 18% to ¥811.4 billion ($5.9 billion) for the year ending September 1989, despite tough competition in the overseas facsimile market and an apparently saturated domestic copier market. The company posted a 12.2% increase in information systems revenues to ¥248.3 billion ($1.8 billion) last year. Net income rose 40% over calendar 1988 figures to ¥21.7 billion ($157.6 million).

Sales of facsimiles were flat last year, hard hit by rivals dumping lower end machines in the U.S. market. Sales volumes, however, were up over 10%. Having discussed with rivals Murata Manufacturing Co. Ltd. and Toshiba Corp. what it saw as unfair price cutting, Ricoh expects the pressure from them to abate gradually this year. Also, if demand in the United States and Europe remains strong, sales should return to a healthy 7 to 8% growth. Sales of group IV facsimile machines should increase in Japan as Nippon Telegraph and Telephone Corp. expands its Integrated Services Digital Network (ISDN) outside major metropolitan areas.

Despite maintenance problems reported last year with the LP6000 laser printer, sales of laser printers increased to the point where they constituted 60% of the company's ¥60.5 billion ($438.5 million) in sales of peripherals.

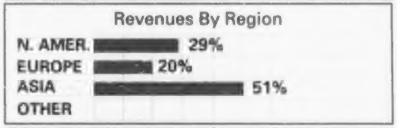
Ricoh continued its aggressive expansion into domestic information systems, selling Hitachi Ltd. PCs and IBM System/55s and System/36s on an original equipment manufacturer (OEM) basis and acting as a sales agent for NEC Corp. office computers. The OEM policy resulted in sales of office and personal computers of ¥17.4 billion ($126 million) and ¥22.3 billion ($161.5 million), respectively, for the year ending in September 1989. However, margins in this area remained a low 4% in 1989, well behind Canon Inc.'s 7% profit margins, the industry's highest. This is largely because Ricoh, unlike Canon, does not sell its own hardware. The use of OEM equipment has also complicated Ricoh's efforts to expand its IS business overseas because it increases the difficulty of addressing after-sale maintenance and software compatibility problems. The company has high hopes that its new optical disk filing systems, which employ 5- and 12-inch erasable disks, will further boost its office automation revenues in the coming year. Sales of optical equipment reached 5% of total sales last year.

Sales of copiers continue to make up 55% of Ricoh's office equipment sales, despite recent efforts to diversify into information systems. The 7% gain in copier sales was due in part to efforts to add value to existing products, which include the introduction of a digitalized intelligence system employing advanced digital technology.

—Stephen Lukow

IS Revenues: $1.45 Billion

REGION **12** **SEIKO EPSON** WORLD **40**



SEIKO EPSON CORP.

3-3-5 Owa, Suwa-shi
Nagano 392, Japan
(81-266)-52-3131

For Seiko Epson Corp., 1989 was a disappointing year, marked by a serious marketing setback in what has long been the company's major strength—laptop computers. Rival Toshiba Corp.'s huge success with Dynabook dealt a crushing blow to Epson's Note, which is functionally comparable to Toshiba's model but more than twice the price.

Launched almost concurrently with Dynabook and operating on two integrated circuit (IC) cards (128 bit and 640 bit), Note is slimmer and lighter than Toshiba's floppy disk-based product. "Our aim was to develop the world's slimmest computer to commemorate the 20th anniversary of the advent of quartz," explains Katsuyuki Kanuma, spokesman for Epson. "Note, which has a built-in communications system and uses a higher quality CPU [central processing unit], is far superior to Dynabook."

Superior technology notwithstanding, sales for Note did not even reach a third of the annual target of 10,000 units last year. But Dynabook surpassed its annual sales target in the first six months of 1989. "We disregarded commercial considerations in the product development," says Kanuma. Despite Note's commercial failure, the company managed to nudge its information systems revenues upward 5% to ¥200 billion ($1.4 billion).

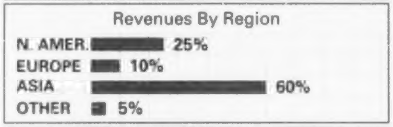
"This year it is our turn to fight back," says Kanuma, although the effects of continued Dynabook success can be felt even more strongly in 1990. To that end, in February, Epson came back with a laptop at exactly the same price as Toshiba's model. The new, cheaper Note operates on a floppy disk as well as an IC card, but is thicker and slightly heavier. Epson's first color laptop also should appear on the Japanese market by the middle of this year. Management had planned to launch the computer last year, but decided to delay until it had developed a mass production technology enabling the company to cut the price to less than ¥700,000 ($5,000). "We are not going to rush into it. We've got to time it right," says Kanuma.

Essentially a printer maker, Epson still commands the top share of the global mini-printer (a calculator-sized printer) market, with total output in 1988 exceeding 100 million units. Today, the company has manufacturing bases in France, the United Kingdom and West Germany and marketing bases in more than 21 countries. In April of this year, Epson established its European Community headquarters in the Netherlands. Until three years ago, exports constituted more than two-thirds of the company's annual revenues, but with the opening of overseas plants, the ratio has dropped to 50%. "The export ratio is likely to decrease even further," says Kanuma.

Would Epson consider tying up with a mainframe company such as Nihon Unisys Ltd. to broaden its product line in the face of ever-intensifying competition? "We're a very independent company, proud of its own technological developments. I don't think our management would even consider such an idea," snaps Kanuma. *—Nobuko Hara*

IS Revenues: $1.35 Billion

REGION **13** **C. ITOH** WORLD **42**


Revenues By Region

C. ITOH & CO. LTD.

5-1 Kita-aoyama 2-chome
Minato-ku, Tokyo 107-77, Japan
(81-3)-497-2121

As one of Japan's top trading companies, C. Itoh & Co. Ltd. is not a large presence in the information systems market. IS accounts for only about 1% of the company's total business.

In fact, the biggest story of C. Itoh's IS business—the sale of its wholly owned U.S. subsidiary, CIE Systems Inc.—resulted from a strategy aimed at expanding the company's satellite business and getting out of what it considers flat growth markets, such as business computers and services.

In January 1990, CIE was sold to General Automation Inc. of Anaheim, Calif., for $4 million. Irvine, Calif.-based CIE manufactures multiuser Motorola 68020- and 68030-based microcomputers, which run the Pick operating system, and sells them to value-added resellers (VARs) in Australia, Europe and the United States. Says Len Mackenzie, president and vice chairman of General Automation, "We're extremely satisfied with what we bought. The C. Itoh acquisition contributed quite nicely to the company's fifth consecutive quarter of profits."

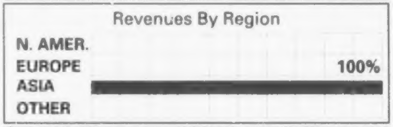
C. Itoh's IS sales grew 26% to ¥185.7 billion ($1.3 billion), continuing a similar rise in growth in the previous year.

In its computer business, C. Itoh primarily sells products made by other companies, such as 9- and 24-pin dot matrix and laser printers made by Tokyo Electron Ltd. In March, C. Itoh and Tokyo Electron entered a joint venture to sell such printers to major original equipment manufacturers (OEMs), including AT&T. C. Itoh's family also includes fault tolerant computers manufactured by Stratus Computer Inc. and workstations from Sun Microsystems Inc.

C. Itoh hopes to realize significant revenues from its aggressive foray into the mobile phone business, taking a 20% stake in a joint venture called Telesat Mobile Inc. of Ottawa. It has also invested in KDD, one of Japan's new long-distance phone companies, to build a network between the United States and Japan. *—Marcia Stepanek*

IS Revenues: $520 Million

REGION **14** **CSK** WORLD **72**


Revenues By Region

CSK GROUP

Shinjuku Sumitomo Building
6-1 Nishishinjuku 2-chome
Shinjuku-ku, Tokyo 163, Japan
(81-3)-344-1811

Value-added networking (VAN) figured prominently in CSK Group's continuing moves last year to diversify its computer services business. For instance, CSK established a new company called Nippon Regiphone Systems Corp. (NRS) to market Regiphone, its point-of-sale (POS) register terminal. Via Regiphone, users can maintain their application systems.

Another VAN affiliate of CSK, RSA Network Corp., installed an estimated 2,000 POS terminals from September 1988 to September 1989. That number is expected to reach 10,000 by the end of 1990. Furthermore, CSK expects its networking business to rise from 8 to 18% of revenues by the year 2000. "The VAN side isn't bleeding them to death," comments one analyst, who estimates that to date, CSK has already recovered half of the ¥20 billion ($145 million) it has invested in its seven VAN subsidiaries.

Nevertheless, with 57% of its computer service revenues coming from software development in the year ending in

September 1989, the company will remain reliant on those capabilities for the near future. CSK's margins in that area remained a little better than the industry average at 6 to 7%. Manufacturing and financial industries made up 35% and 31% of software development revenues, respectively.

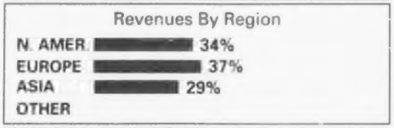
The stress the company's founder, Isao Okawa, places on educating employees may give the company an edge against its big rivals, as the most severe problem in the Japanese software industry is keeping customers from hiring away software developers. To that end, CSK put 850 new employees through a six-month course in specialized system engineering and knowledge engineering at its new CSK Computer and Information Education Center.

For the period from September 1988 to September 1989, CSK's total revenues were ¥71.8 billion ($520 million), a 20% increase over the same period in the year before. CSK has experienced strong growth in the steel and electrical appliance markets, as well as increased demand from distribution companies. CSK expects more of its business to come from the distribution sector, which lags behind the manufacturing and services sectors in its degree of computerization.

CSK's computer hardware sales rose 15% to ¥17 billion ($123 million), reflecting an increase in sales of small- to medium-sized computers. Major developments in this area included CSK's second joint venture with IBM Japan, called CSI Corp. Ltd., which will develop, market and support IBM systems coupled with CSK-designed software. *—Stephen Lukow*

IS Revenues: $493.7 Million

REGION		WORLD
15	ACER	75



ACER INC.

602 Min Sheng East Road
Taipei 10445, Taiwan
(886-2)-718-2349

Last year was another record-breaking year for Acer Inc., the Taiwanese company that until now has focused its efforts on high-end personal computers. Acer's calendar 1989 IS sales reached NT$13 billion ($494.7 million), and with the production of its one millionth PC, the company topped even its own ambitious targets. But the year was important for another reason: Acer's ebullient chairman and chief executive officer, Stan Shih, devised a new strategy that is intended to serve the new company throughout the nineties.

Globalization will be Acer's main thrust in the next decade, as it adds sales offices around the world. The new strategy also envisions a major diversification for the company in three directions: software, semiconductors and networking. Recognizing that hardware is rapidly becoming a commodity product, Shih wants to position the company as a major software supplier, particularly for the Chinese business community which dominates the economic activity of Southeast Asia. With this goal in mind, Shih hired Leonard Liu last year as president of Acer. Liu, who had been general manager of IBM's Santa Theresa, Calif., software development laboratory, was a 20-year veteran with Big Blue.

Acer's new focus on the Southeast Asian market underscores the region's continued rapid growth rate—at a time when European and U.S. market growth is slowing down—and the renewed interest in running computers, particularly PCs, in local languages.

Acer is already the largest software distributor in Taiwan, acting as the exclusive distributor there for Microsoft Corp. and Ashton-Tate Corp. The company has participated in the development of a Chinese version of MS-DOS in cooperation with Microsoft and has introduced a Chinese version of Ashton-Tate's dBASE III. Acer also added to its software stable last year by acquiring Princeton Publishing Labs Inc., a New Jersey-based developer of desktop-publishing software.

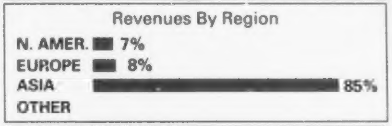
By establishing a joint venture with Texas Instruments Inc. to manufacture 1- and 4-megabit dynamic random access memories (DRAMs) in Taiwan, Acer is assuring itself a supply of these critical components. But because memory prices tend to ride a roller coaster, this may be one of Acer's riskier investments. In the new venture, Acer will own 74% of a $250 million manufacturing facility, the only one of its kind in Taiwan. Acer has also concluded agreements with National Semiconductor Corp. whereby the two companies will jointly develop very large scale integrated (VLSI) chips and National will market chip sets designed by Acer.

To cash in on the trend to network PCs, Acer has set up a new business unit called Network Computing Business, which will supply integrated network computing solutions. The new unit will report to Liu, who once was group director of communications and programming at IBM.

—Lew Young

IS Revenues: $420.4 Million

REGION		WORLD
16	ALPS	86



ALPS ELECTRIC CO. LTD.

1-7 Yukigaya ohtsuka-cho
Ohta-ku, Tokyo 145, Japan
(81-3)-726-1211

A drain on profitability continued at Alps Electric Co. Ltd. in 1989, largely due to the Tokyo stock market crunch, lowered export values and higher overseas operating costs caused by unfavorable foreign exchange rates and continued price cuts demanded by customers in Japan and abroad.

Consolidated corporate revenues for the fiscal year ending in March 1990, including all Alps subsidiaries, were up 6% to ¥400 billion ($2.9 billion). Revenues for the parent company alone were up slightly, by an estimated 3% to ¥315 billion ($2.3 billion). Although operating profits at the parent company, fueled by the stronger dollar, increased by 52% to ¥10 billion ($72.4 million), net profits were down about 16% to ¥5.1 billion ($3.71 million) according to securities analysts. The story was worse at Alps' subsidiaries, where profits were pummeled, according to investor bulletins issued in May. Compared with calendar 1988 figures, consolidated net income for all of Alps, both parent company and subsidiaries, plummeted nearly 91%, from ¥5.5 billion ($42.9 million) to ¥500,000 ($3.6 million).

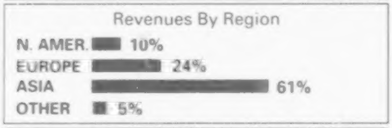
Substantial losses were incurred at Alps' Tohoku, Japan, floppy disk drive subsidiary, California-based Alps Electric (USA) Inc. Market analysts blamed those losses on price-cutting pressures fed by the stronger dollar. Alps' Korean subsidiary also suffered, mostly due to rising domestic costs fueled by the appreciation of the Korean won.

To help compensate, the firm has been expanding its European operations, boosting manufacturing capability for various electronic components. It was through such components that Alps first entered the information-processing business, and the company's strengths continue to lie in that area. In the United Kingdom, it boosted its videocassette recorder (VCR) components business and last August opened a ¥3.4 billion ($25 million) plant in West Germany to make heads for audio equipment.

While it's obvious that Alps' printer and peripherals business has not proven profitable, the company continues to be the world's largest independent supplier of floppy disk drives and commands a 60% share of the world's power switch market. It also continues to supply keyboards to IBM and other top PC makers. *—Marcia Stepanek*

IS Revenues: $380 Million

REGION 17
MITAC
WORLD 94



MITAC INTERNATIONAL CORP.
585 Ming Sheng East Road, Eighth Floor
Taipei, Taiwan
(886-2)-501-8231

Mitac International Corp. is the second Taiwanese computer company (Acer Inc. was the first) to have broken away from the country's heretofore typical pattern of cloning other companies' products and selling them as cheap copies. The change in marketing strategy for Mitac and others is largely the result of a conscious, unified movement on the part of Taiwanese industrialists to get brand name recognition for their products worldwide.

Indeed, computers bearing Republic of China company names have spread throughout Asia and much of the rest of the world. In achieving this marketing change, Mitac, like Acer, has focused on the high-performance end of the personal computer market. In calendar 1989, Mitac's personal computer sales grew 25% to NT$4.7 billion ($178.6 million) as the company aggressively marketed its small footprint desktop machines built around Intel Corp.'s 80286 microprocessor and introduced new high-performance units and engineering workstations built around the 80386 and 80486 microprocessors. Of the company's total 1989 PC sales, 60% were brand name sales, up from 55% in 1988. Nearly 75% of Mitac's sales growth in PCs came from the increased number of its brand name computers in the market.

Sales for the Mitac Group, which includes the computer company, last year grew 49% to NT$10 billion ($380 million).

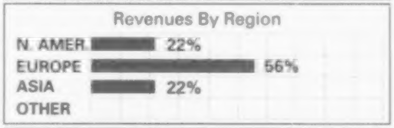
It is no coincidence that Mitac concentrated on machines with Intel microprocessors at their heart. The company started in business in 1974 as the Taiwanese distributor for Intel semiconductors, and it still acts in that capacity. Matthew F.C. Miau, Mitac's chairman and cofounder, had been a product design manager at Intel in California before he helped set up Mitac in Taipei.

Miau also has set the company on a track of diversification. In 1990, Mitac will begin production of its first laptop computer. A new company, Micro Integrated Communications Corp., has been established in the United States to develop the company's capabilities in communications. Mitac's purchase of 12% of Wyse Technology last year was also a part of this diversification.

In eyeing its information technology future, Mitac closely scrutinizes the moves of its most bitter rival, Acer. Maybe not coincidentally, the headquarters of the two companies are located only two blocks apart on Taipei's busy Ming Sheng East Road. *—Lewis H. Young*

IS Revenues: $366.4 Million

REGION 18
KYOCERA
WORLD 97



KYOCERA CORP.
5-22 Kitainoue-cho Higashino
Yamashina-ku, Kyoto 607, Japan
(81-75)-592-3851

1989 was a landmark year for Kyocera Corp., the world's largest manufacturer of integrated circuit (IC) ceramic packages. The company made two major overseas investments designed to reduce its dependence on its mainstay ceramics business and place increased emphasis on data communications and electronic parts and components. The moves were also seen as a way to recover from a downturn in earnings in the second half of the year caused by reduced semiconductor demand in the United States.

In late July, Kyocera bought California-based electronics parts maker Elco Corp. for $250 million, giving the firm full control of a number of Elco companies in various countries, including Japan, South Korea, the United Kingdom and West Germany. At the end of September, Kyocera bought another U.S. electronics parts maker, AVX Corp., for stock valued at $561 million. Kyocera says the buyout of AVX—which has a strong manufacturing presence in Europe—was aimed at giving the company a production foothold in Europe in preparation for the 1992 European Community market integration.

The new emphasis on electronic equipment is in keeping with chairman Kazuo Inamori's principle of keeping innovation within the company. Three years ago, this part of the company was in the red, but it now accounts for 10% of the firm's profits. Revenues for information systems, which were ¥50.6 billion ($366.4 million) in fiscal 1989 (ending March 31, 1990) currently represent only about 15% of Kyocera's overall sales of ¥339 billion ($2.5 billion), but the company hopes to greatly enlarge that share.

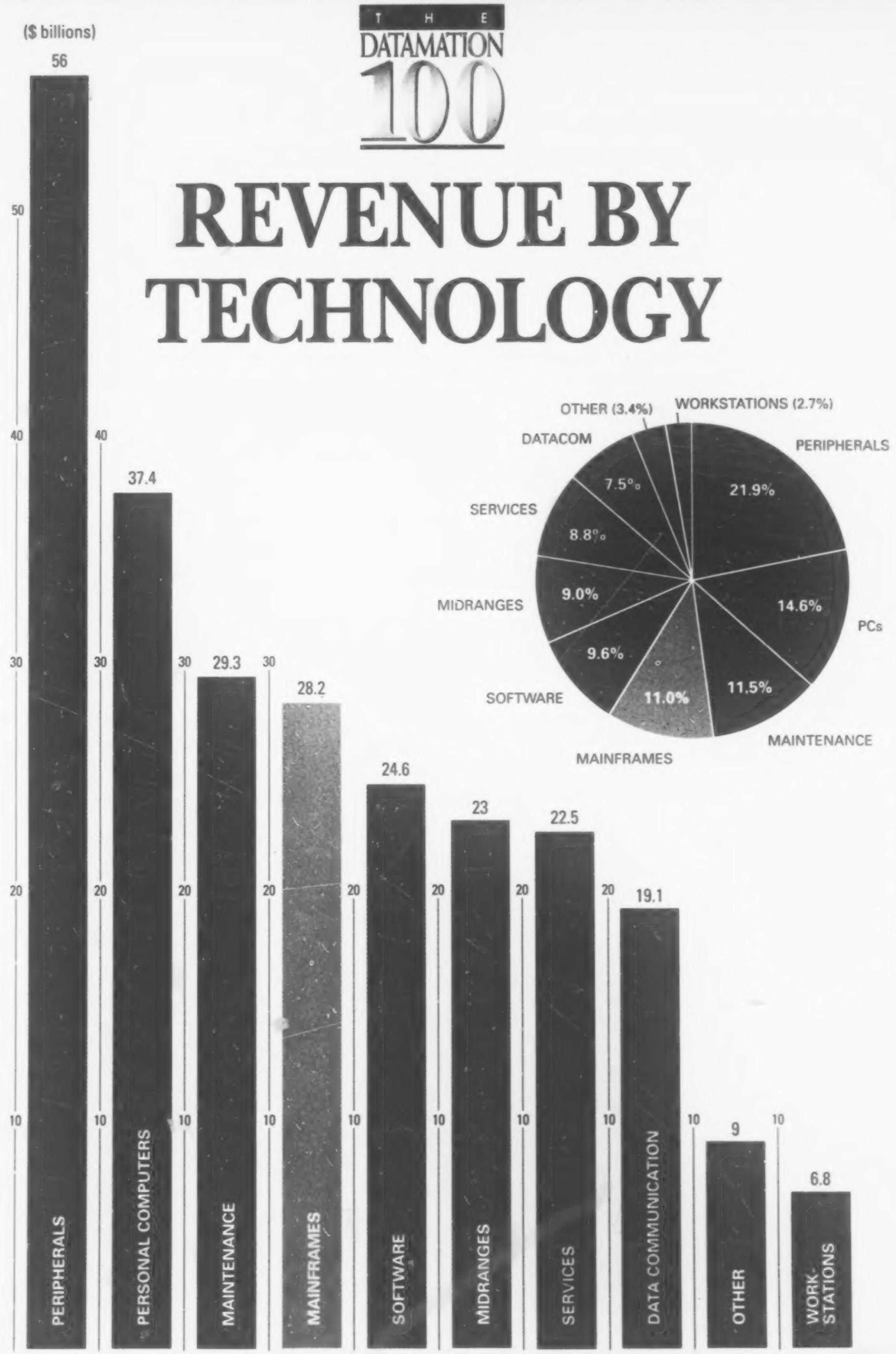
Having targeted PCs as one of the main growth areas, the company in 1989 introduced 16- and 32-bit versions of its 80386-based AX PC series. Sales of the 40-megabyte desktop units, which went on the market in October, have so far not been strong, but Kyocera is undaunted and plans to release a 100MB 32-bit model in the near future. However, 80% of Kyocera's PC sales are still original equipment manufacturer (OEM) units sold in Europe.

Sales of the company's other main IS product, laser printers, do remain strong. Most of these printers are sold in the European market. Last year, Kyocera introduced three new laser printer models and plans to market them both domestically and overseas.

In personnel news, executive vice president Kensuke Ito was promoted to the company's presidency, replacing Kinju Anjo, who will become one of two vice chairmen. *—Steve McClure*

THE DATAMATION 100

REVENUE BY TECHNOLOGY



PCs & WORKSTATIONS

Desktop Systems Become Network Stars

More sophisticated servers, early OS/2 applications and the spread of networked machines marked events in personal computing in 1989.

BY JOHN O. DUNKLE

With more networks sinking deeper into companies of every type and stripe, the personal computer became more of an interpersonal tool in 1989. In fact, by the end of the decade, just over 65% of the PCs found within the office environment were connected. This trend will continue to gain momentum as over 82% of the PCs within organizations are expected to be networked within the next two years.

But, to fully appreciate 1989, one must revisit predictions that were made at the end of 1988, when the promise of OS/2 was still fresh in users' minds.

486-based PCs are slow to catch on.

It was predicted that graphical user interface (GUI) standards would allow applications for different operating systems to achieve a high level of commonality. Industry pundits were touting the benefits of "groupware," even though a definition didn't exist. IBM's proprietary Micro Channel bus architecture would soon fall victim to the Extended Industry Standard Architecture (EISA), a rival bus being peddled by Compaq Computer Corp. and eight other companies, the so-called Gang of Nine. Apple devotees would be able to purchase a low-cost Macintosh priced at less than $1,000. And, finally, Steve Jobs would blow the doors off the industry with the NeXT machine.

The ABCs of PCs

Overall, the PC industry showed signs of maturity in 1989.

- Product life cycles shorten to just over two years, compared with five years previously.
- PC buyers hesitate on new purchases, as vendors pump out more new technology, such as 386- and 486-based PCs, than users can absorb.
- Competition among thinning ranks of vendors increases, as market dollar growth slows to 13%.
- Networking of PCs increases as better peer-to-peer communications capabilities become available.

Source: WorkGroup Technologies

So much for predictions. The promise that OS/2 brings to the personal computer market is still waiting to be fulfilled. The graphical user interface standard doesn't exist. Groupware remains undefined. Micro Channel gained in market share, and the industry was left waiting for the general availability of EISA-based products. The low-cost Mac has yet to arrive. And, finally, users are waiting for the NeXT product from Jobs' company, NeXT Inc.

However, several important developments occurred or continued to unfold in 1989. Compaq introduced the SystemPRO, the first tightly coupled symmetrical multiprocessing server available. Apple Computer Inc. brought out its long-awaited portable. The first OS/2 applications began to appear on dealers' shelves. Application developers and companies producing operating systems for local area networks took an enterprisewide approach to the integration of work groups and PC-based applications. Vendors reevaluated and committed to a long-term personal computer strategy for embracing a robust distributed-computing model. All in all, 1989 was an exciting year in the development of technology.

In products, however, 1989 was somewhat of a disappointing year for users expecting next-generation PS/2 machines from IBM. Despite the introduction by IBM of the i486-based PS/2 PowerPlatform card, there weren't any new dedicated high-end products for users who needed to upgrade personal computers beyond 286/386 performance. This left a void that Compaq, Dell Computer Corp., Hewlett-Packard Co. and others were all too willing to fill. However, in the latter part of 1989, IBM did issue a statement of direction with regard to the incorporation, beginning this year, of its next-generation Micro Channel Architecture in PS/2 products. This statement covered faster bus speeds, transfer rates and system throughput.

The year was also marked by:

- **Shorter product life cycles.** PC product life cycles shrunk to just over two years, compared with the previous five years. This time compression demonstrates how quickly technology at the PC level is evolving. Hardly had the 80386-based PCs captured the attention of the market in 1989 than users were evaluating several products based upon the i486.
- **Buying hesitation.** Managers responsible for PC purchases evaluated a wide span of PC technologies, including high-performance products suitable as servers and lower cost PCs for more traditional applications. However, user organizations' ability to absorb newer generations of technology as rapidly as the technology was being pumped out by vendors became questionable. Sales of 80286-based PCs outstripped antiquated 8088-based systems in 1989, but 286 sales also far outstripped those of the more powerful 386 and

The Top 10 in PCs

With the acquisition of Zenith Data Systems, Groupe Bull is now a major player in PCs.

	DTM 100 RANK	COMPANY	PC REVENUES 1989 ($MIL.)	PC REVENUES 1988 ($MIL.)	% CHANGE	MARKET SHARE*
1	1	IBM	8,343.0	7,150.0	16.7%	22.3%
2	11	Apple	3,574.2	2,950.0	21.2%	9.6%
3	3	NEC	3,116.5	2,492.3	25.0%	8.3%
4	16	Compaq	2,876.1	2,065.6	39.2%	7.7%
5	8	Groupe Bull	1,681.0	318.0	428.6%	4.5%
6	10	Olivetti	1,523.4	1,427.5	6.7%	4.1%
7	13	Toshiba	1,340.8	1,083.4	23.8%	3.6%
8	31	Tandy	1,330.0	1,232.2	7.9%	3.6%
9	5	Unisys	1,300.0	1,050.0	23.8%	3.5%
10	4	Fujitsu	869.7	829.4	4.9%	2.3%

* Percentage share of DTM 100 revenues

Data General steps toward open systems with Aviion.

486 offerings.

- **Competition**. PC market growth in dollar terms sagged to an industry all-time low of 13%, according to WorkGroup Technologies of Hampton, N.H., adversely affecting many major computer manufacturers and small PC dealers. The entry-level price for a new 286-based system fell well below the $1,000 threshold and even new 80386SX-based products were offered at a street price under $2,000. The price competition, among other factors, caused many vendors to slash their 1989 earning expectations as early as May, chop employee ranks and downsize operations and programs—and those manufacturers were the lucky ones. The less fortunate were either acquired or faded quickly out of view.

The Top 10 in Workstations

Buying Apollo made Hewlett-Packard No. 3 in workstations.

	DTM 100 RANK	COMPANY	WORKSTATION REVENUES 1989 ($MIL.)	1988 ($MIL.)	% CHANGE	MARKET SHARE*
1	27	Sun	1,443.8	1,096.2	31.7%	21.3%
2	2	Digital	1,195.0	700.0	70.7%	17.6%
3	7	HP	825.0	438.0	88.4%	12.2%
4	15	Matsushita	800.9	N/A		11.8%
5	1	IBM	591.0	552.0	7.1%	8.7%
6	42	C. Itoh	471.1	N/A		6.9%
7	20	Xerox	325.0	400.0	-18.8%	4.8%
8	52	Intergraph	260.0	150.0	73.3%	3.8%
9	6	Hitachi	181.2	N/A		2.7%
10	22	STC	114.5	N/A		1.7%

* Percentage share of DTM 100 revenues
N/A= Not Applicable

- **Connectivity**. The trend of moving corporate computing away from the dedicated mainframe environment continued. Corporate information became increasingly produced by and maintained in multiple work groups throughout the organization. For this reason, the traditional PC, midrange and mainframe environments have changed substantially.

Midrange systems continued to evolve into line of business computers, acting as file repositories for their own cluster and as a server when communicating to other work groups. This peer-to-peer communication capability is becoming the foundation of the successful implementation of servers in multiple-domain, enterprisewide work groups. The centralized mainframe environment continued to evolve toward enterprise network management.

What's Coming Up?

Operating systems supporting multiuser distributed applications are now being closely scrutinized by most IS executives. According to WorkGroup Technologies, in 1989, over 65% of IS managers evaluated UNIX and most also evaluated OS/2 Extended Edition. The fundamental difference between UNIX and OS/2 is that UNIX is an application development environment and OS/2 is an application-processing environment. Today, far more applications are available under UNIX than OS/2. WorkGroup expects this trend to continue through 1990. Applications that take advantage of all the features that OS/2 Extended Edition provides will not be widely distributed until 1991.

WorkGroup also expects that GUIs like Microsoft Windows, OS/2 Presentation Manager, the Open Software Foundation's Motif interface, and UNIX International Inc.'s Open Look will become the major forces driving rapid customer acceptance of PC and workstation operating systems. And the ease of use provided by GUIs will foster the rapid development of compound documents. Compound documents let users combine text, images and graphics into a single file. We expect compound documents to become the communications medium for tomorrow's corporate information systems.

Compaq's SystemPRO is introduced.

But due to the large file size of a single compound document, enterprise communications capabilities will be pushed to the limit. In preparation for this, IBM has increased the capabilities of its Token Ring from 4 megabits per second to 16Mbs. We expect to see other vendors following IBM's lead in the near future. ▭

John O. Dunkle is vice president, work group computing, of WorkGroup Technologies in Hampton, N.H.

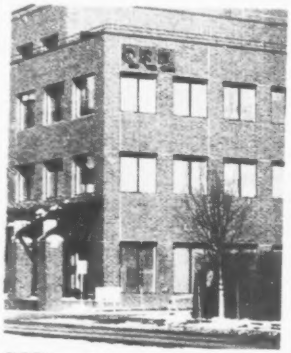
MIDRANGE

Two Markets, Many Challenges

Last year's trends set the stage for the drama that will be played out in the 1990s, when the midrange market splits in two.

BY STEPHANIE JOHNSON AND PAUL ZORFASS

The midrange market has been buffeted by change ever since Digital Equipment Corp. first began churning out computer processors from its converted Civil War mill in Maynard, Mass., back in the late 1950s. The greatest and most turbulent period of change, however, is expected in the mid-1990s, when the market is destined to split into two disparate segments, the midrangers North and South.



OSF headquarters: Waging warfare over UNIX.

Taking the slower and lower road to the South will be vendors offering wares that war with low-end PCs and workstations. Taking the high road to the North will be stronger forces offering local area and wide area network server platforms, along with other departmental and networked-computing schemes.

While this division of the market is no Civil War of computing, it will nevertheless result in dramatic distinctions, some of which were clearly perceptible last year. In 1989, the midrange experienced reasonable growth, generating revenues of some $28 billion. Within the next several years, the Yankee Group predicts that this growth will be running within the range of 7 to 9%.

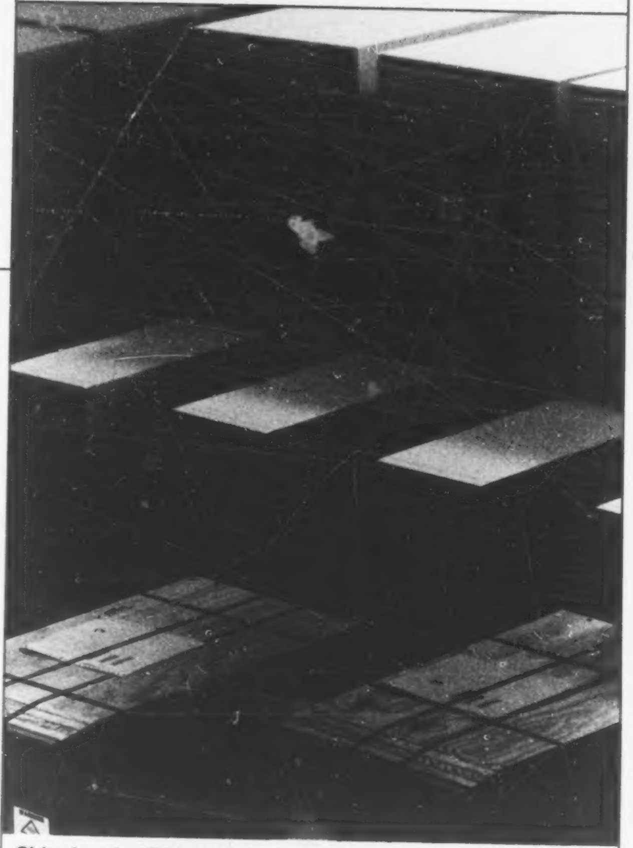
At the top of the trends fueling that growth in 1989 was UNIX. AT&T's System V release 4 V.4 promises to make everyone's life easier, particularly midrange vendors. Now, at least, they have a realistic target against which to compare their own UNIX versions (Hewlett-PackardCo.'s HP-UX and Digital's UL-TRIX, for example).

Roaming the Midrange

The market begins to split as vendors compete at the low end against PCs and workstations and at the high end in the LAN/WAN server markets.

- AT&T unveils release 4 of UNIX System V, which expands the role of UNIX from merely an operating system to an open environment.
- RISC moves into the midrange mainstream.
- OSF announces its Motif graphical user interface; Digital works on a GUI for its midrange servers.
- The proliferation of PC LANs eats at the midrange market, but also opens up opportunity for midrange services in client/server configurations.
- Midrange systems continue to dominate in the image-processing application arena.

Source: Yankee Group



Shipping the IBM AS/400 to a LAN near you.

The most important thing about System V release 4 is that it changes the whole concept of UNIX. No longer can UNIX be viewed as only an operating system. Now with V.4, the software evolves into an actual operating environment. UNIX International Inc.'s announcement of environment enhancements earlier this year reinforced this environmental image.

The UNIX battles, however, are still not over. OSF/1, the Open Software Foundation's answer to V.4, has yet to be unleashed. But the decision that users will eventually make about which UNIX to use will hinge less on technology and more on other pragmatic considerations. In weighing those considerations, they'll be opting for the UNIX system that offers the best tools and techniques to create an open environment to protect their software investments, to reduce vendor dependence and to lower integrations costs.

RISC in the Mainstream

Last year, one technology that really moved into the mainstream of the midrange market was reduced instruction set computing (RISC). HP was the first midranger to run with RISC, incorporating the technology into its Precision Architecture. Next, Data General Corp. entered the RISC race with its Aviion system, which is built on the 88000 RISC chip from Motorola Inc.

Several months later in July, mighty middie Digital announced that it was offering RISC on its 5000 series DECsystems. The Massachusetts manufacturer, which had already made its RISC

The Top 10 in Midrange

IBM's AS/400 and Tandem's OLTP machines were bright spots in a desultory year for the midrange.

	DTM 100 RANK	COMPANY	MIDRANGE REVENUES		% CHANGE	MARKET SHARE*
			1989 ($MIL.)	1988 ($MIL.)		
1	1	IBM	6,753.0	4,400.0	53.5%	29.4%
2	2	Digital	2,670.0	2,981.5	-10.4%	11.6%
3	3	NEC	1,471.3	1,447.5	1.6%	6.4%
4	4	Fujitsu	1,304.6	1,225.2	6.5%	5.7%
5	5	Unisys	1,122.0	1,080.0	3.9%	4.9%
6	13	Toshiba	978.4	1,092.1	-10.4%	4.3%
7	7	HP	750.0	750.0	0.0%	3.3%
8	37	Tandem	709.6	557.0	27.4%	3.1%
9	10	Olivetti	607.0	614.3	-1.2%	2.6%
10	21	Wang	570.0	912.1	-37.5%	2.5%

* Percentage share of DTM 100 revenues

move on the workstation front in January, was clearly signaling its commitment to the technology for its midrange systems. It was also signaling its willingness to bring in outside technology: in this case, the RISC muscle came from MIPS Computer Systems Inc., in which Digital holds around a 5% equity stake.

Digital was also active last year in the key area of graphical user interfaces (GUIs). For the past three years, all of the major midrange vendors have been working on these front-end environments, which promise to open the door to more effective end-user computing.

OSF gave the GUI movement a major push when it announced last year that it would begin shipping in August its Motif GUI, which is built on component software from Digital, HP and Microsoft Corp. The windowing facility in DECwindows will eventually enable Digital to support multiple desktop environments using a midrange server. The same type of support will also be available for HP's NewWave windowing facility.

The base layer in these support environments is the X Window System. Developed at the Massachusetts Institute of Technology, X Windows features an object-oriented approach to software components and information. The X Windows standard has in fact provided a rallying point for advocates of object-oriented products. Still, object-oriented software techniques have yet to make major inroads in the midrange, inroads that have already been achieved in the PC market.

An increasing number of PCs were deployed last year in local area network schemes. In the LAN arena, PCs are clearly a threat to midrange machines. But they also represent an opportunity for those midrange systems that are tailored around a client/server architecture. Operating as a server in a PC LAN management role, IBM AS/400s or Digital MicroVAXs can quite easily provide application, system and programming services.

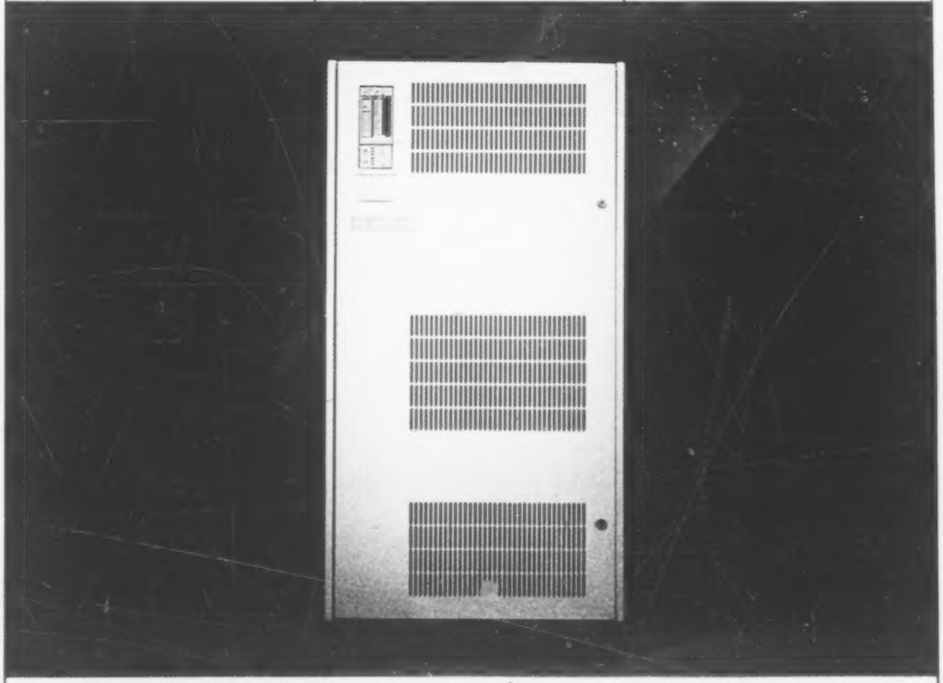
At Your Service

This server role for midrangers was already in evidence last year. After all, midrange systems are proving to be robust and reliable servers and platforms. And robustness and reliability are especially important when it comes to on-line transaction processing (OLTP). In fact, it's the fault-tolerant features of midrange machines that make them more attractive than PCs for OLTP applications.

An increasing number of these OLTP applications are distributed, a trend that is well served by midrangers. Nevertheless, client/server OLTP based on PCs or workstations is coming into computing vogue. So, to stay in fashion, midrangers will have to make sure their distributed OLTP approaches are compatible with popular PC LANs.

One application area that midrange systems continued to dominate last year was image processing. This strong position should stand midrangers in good stead in the years ahead. By 1992, the market for image processing and storage, which is valued at $500 million today, is expected to explode to $2.5 billion. ▭

Stephanie Johnson is general manager of the Yankee Group in Boston. Paul Zorfass is senior director of computer research at the Yankee Group.



Now serving: Digitals VAX 6000.

MAINFRAMES

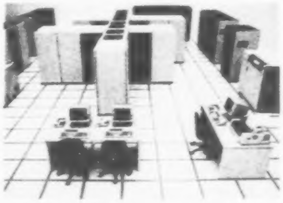
The Age of the POWERframe Is Here

Large scale corporate systems are ending one era and beginning another.

BY JOSEPH PAYNE

In 1989, the mainframe died. In its place, the POWERframe was born—the high end in a trio of new computing architectures to emerge for the 1990s.

The birth of a new generation of large scale corporate systems last year propelled the market, including peripherals, to $20 billion—10% higher than the previous year. That's exceptionally healthy given that it's harder to grow big markets than small ones and given the amount of discounting on old-generation mainframes in the market during the year.



IBM is still the strongest POWERframe player of all.

But what's driving such growth? What factors brought an end to the 25-year-long super product cycle of the mainframe as we knew it? And what is likely to follow? The answers all revolve around standardization embedded into and deliverable in system software form.

The Old and the New

The mainframe was *main* because it was the central point of residence of shared logic—the host. It was the first to use punch cards, then teletypes and finally terminals. This now obsolete host was a computer—usually a very big one—surrounded by its users, numbering hundreds or even thousands. Bigger need was satisfied by getting a bigger computer.

For most of the past 25 years, that time-sharing-based paradigm served as the single notion of what computing should be. But, in the latter years of that supercycle, the typical organization's deployment of computing changed. Increasing numbers of users traded in dumb input for smart input—i.e., swapping terminals for PCs.

Building on the notion of a framework that could accommodate much more smart input, a new product supercycle has begun that can be seen as a hierarchy of frames. Here are their classes:

- **POWERframes.** Characterized by the ability to interface with different forms of databases, these machines have parallel processors sharing an organizationally common memory and storage hierarchy. Their chief task is to regulate the flow of traffic into and out of those databases over a parallel access input/output structure called channel architecture. Their hallmark, beyond extraordinarily high instruction execution rates, is enormous communications bandwidth—giving them the ability to move massive amounts of data throughout any user organization.

Tandem swirls into competition with Cyclone.

- **SERVERframes.** Unique in their ability to serve up a locally shared database to a work group or a single user, these machines also can access organizationally collective databases.
- **CLIENTframes.** Home of all new applications and all human interface features, these machines eventually will allow users to automatically generate their own applications.

In the real world of organizationally adaptive computing architectures, the structure of a useful system of processing frames is bilevel. One level of this two-tier architecture is database automation; that's where you will find POWERframes. The other is office automation; that's where SERVERframes and CLIENTframes fit. Each level has a plethora of horizontal applications, intertwined by many webs of vertical applications.

None of the foregoing is really that much different than anybody else's view of the new computing system paradigm. But looking at large scale systems within this particular framework can make a few things clear. First, the thoroughly useless label known as "mainframe" should finally be laid to rest. Second, the eminently useful class of systems, POWERframes, was extremely strong in 1989 and should continue to be so in the 1990s. Third, the strongest POWERframe player of all, IBM, continues to define the class.

IBM Is Still the Market

IBM's very large share of the commercial high-performance computing market—at least six times that of any other single competitor—ensures that its system software is universally accepted as the de facto standard. This position is strengthened by a continuing rollout of software products by IBM and independent developers that comply with IBM's computing blueprint known as Systems Application Architecture (SAA).

The strength of the IBM operating system compatible (IBM-OSC) POWERframe market is undeniable. Last year, IBM's POWERframe (computer only) revenues increased 12% to more than $12 billion even

The Main Events in Corporate Systems

Being compatible with or competing against IBM was the name of the game.

- Hitachi Data Systems, a company owned by Hitachi and Electronic Data Systems, is born out of the remains of National Advanced Systems.
- Fujitsu introduces its MSP-EX operating system, aimed at boosting IBM compatibility, and later announces that it will export the MSP-EX system to West Germany's Siemens on an OEM basis, the first time a Japanese computer company has sold operating systems outside Japan.
- Amdahl announces the availability of ESA/370 and MVS/ESA on its 5990 series of mainframes.
- IBM unveils 16 J and J/H models of 3090, along with an extension of ESA.
- Digital and Tandem enter the mainframe market with the VAX 9000 and Cyclone products, respectively.

Source: Alex. Brown & Sons Inc., Cowen & Co., DATAMATION.

after the debilitating effects of currency translation adjustments. In local Western European currencies, IBM's POWERframe revenues may actually have expanded by as much as 25%.

Add to IBM's results those of Amdahl Corp. and Hitachi Data Systems Corp. for a full IBM-OSC market profile. Amdahl's processor and storage revenues totaled $1.65 billion, Hitachi Data Systems some $500 million. The collective IBM-OSC POWERframe market picture for 1989 was clearly one of expanding size and strength.

The big story of 1989 was the substantial increase in the number of IBM-OSC POWERframe users that have embraced IBM's Enterprise Systems Architecture (ESA) extension of its MVS operating system. The market currently available to run MVS/ESA represents half of the installed base of high-performance IBM-OSC computing systems. The other half is either loyal fans of VM or DOS/VSE variants or those that have not yet upgraded to ESA-qualified hardware.

IBM experienced stunning growth of its ESA licenses in 1989, from slightly more than 15% of the available market at the end of 1988 to more than 50% at the end of 1989. As much as 40% of the installed Amdahl market also moved up to ESA. IBM indicates that an ESA version of its VM operating system is on the way. And it has identified DOS/VSE as a strategic product because it can be controlled, distributed and downloaded from ESA/MVS sites.

Digital steps into the ring with the VAX 9000.

Driving demand for ESA, and the POWERframes needed to run it, are the capabilities of the architecture itself and the forces of distributed computing. ESA can manage memory and channel architectures much more efficiently than could previous generations of operating systems, practically automating the management of storage.

The Top in Large Scale Systems

IBM continues to lead the market—in revenues and technology.

	DTM 100 RANK	COMPANY	MAINFRAME REVENUES 1989 ($MIL.)	MAINFRAME REVENUES 1988 ($MIL.)	% CHANGE	MARKET SHARE*
1	1	IBM	12,509.0	12,138.8	3.0%	44.4%
2	4	Fujitsu	3,261.5	3,248.5	0.4%	11.6%
3	6	Hitachi	3,116.5	2,897.5	7.6%	11.1%
4	3	NEC	2,391.8	2,394.4	-0.1%	8.5%
5	26	Amdahl	1,470.8	1,225.2	20.0%	5.2%
6	5	Unisys	1,200.0	1,175.0	2.1%	4.3%
7	8	Groupe Bull	840.5	901.0	-6.7%	3.0%
8	56	Cray	633.6	632.9	0.1%	2.2%
9	9	Siemens	611.7	683.4	-10.5%	2.2%
10	22	STC	466.1	658.4	-29.2%	1.7%

* Percentage share of DTM 100 revenues

Source: DATAMATION.

Source: DATAMATION.

Power and Price

The processing punch of POWERframes lies underneath an organization's computing environment, a fact that obscures the importance of this market. Aimed at automating databases and everything else that moving data around an organization requires—memory, storage and input/output channel management—end users are far removed from such power. The MIPS muscle of CLIENTframes, in contrast, lies right in front of users. The millions of instructions executed per second by workstations are focused on the screen, making applications user friendly and making this market segment seem overly important.

Punch and *price* were the operative words in the market in 1989. Amdahl raised the stakes of the MIPS ratings contest with its 5990 mainframe system, which began to be shipped last year. It is 50% more powerful than its IBM 3090 counterpart. Hitachi Data Systems attracted attention merely with the rumor of Andromeda, a machine speculated to be even 40% more powerful than the Amdahl machine.

Look for announcements like Andromeda by the end of this year and for shipments of 40 to 50MIPS processors from Hitachi and others to be commonplace by the end of 1991. Configurations of up to six or eight processors, at those processor performance levels, sharing truly awesome main memory and storage spaces, will define high-end POWERframe systems. Naturally, questions arise: What will users do with 240 to 400MIPS per system? Answer—move data. More significant might be the question: How much will that cost?

POWERframes of the next supercycle will enter the market at $50,000 to $75,000 per MIPS. Asking prices of $15 million to $20 million per machine will be common.

Also look for more competition in POWERframe-based computing in the future. Two new entrants in 1989 brought early technology to this market segment. Digital Equipment Corp. and Tandem Computers Inc. came to market with the industry's first POWERframe superscalar design implementations. A superscalar architecture executes more than one instruction per processor cycle.

What About the Others?

Tandem and Digital are the two leading non-IBM-OSC vendors that strengthened their competitive positions by moving up into the POWERframe market in 1989. But the POWERframe market for the most part was also good for Bull HN, Control Data Corp., Fujitsu Ltd., Hitachi Ltd., Siemens AG, STC PLC and Unisys Corp. Amazing, you say? Overall, the entire POWERframe installed base in 1989 generated revenues of $20 billion, up an estimated 10% That is big growth for such a big base.

There were, however, cross currents within the non-IBM-OSC market. Unisys did reasonably well with its model 2200 large-scale systems, upgrading customers that had purchased model 1100 systems when they were marketed by Sperry Corp. before merging with Burroughs Corp. to form Unisys. Revenue generation from the Burroughs customer base, meanwhile, continued to slip. Bull HN held its own ground in the North American market; that in itself is surprising. Control Data was flat, with revenues at an estimated $0.5 billion, but is now offering booster processors made by Convex Computer Corp. to its installed base (1,800 units) of Cyber 900 customers. ☐

Joseph Payne is a securities analyst who follows mainframe and minicomputer companies for Alex. Brown & Sons Inc., a brokerage firm in Baltimore.

PERIPHERALS

Everybody's Fighting For Your Business

Users are in the driver's seat. They can command greater features at lower prices for printers, terminals and storage as global competition heats up.

BY GREG BLATNICK, PHIL DEVIN AND JIM UPHAM

The biggest segment of the worldwide information technology industry is the least glamorous to most people. Peripherals manufacturers—companies that make the printers, terminals and storage devices used with computers—don't seem to generate the headlines that computer makers, networking companies or software suppliers do.

IBM's first run at laser printing.

Not that peripherals makers didn't try to attract attention in 1989. The printer industry saw unprecedented battles in price and performance. The terminals industry lost some of its luster in the United States. And the storage industry consolidated faster than anyone predicted.

Desktop Printer War

In 1989, war broke out in the electronic printer industry as suppliers of different types of desktop printing machines brandished features and prices in an all-out fight for customer orders.

But, as the year began, the desktop printing field was peaceful. Constituents knew their places and rarely crossed boundaries. Dot matrix printers allowed users to output spreadsheet calculations and other documents meant for internal use. Ink-jet printers, somewhat a novelty, gained acceptance because of their quiet, letter quality performance. Laser-based page printers served users whose needs for high-quality output justified the higher cost of the machines and the networks usually running them.

But the right choice for a printing solution became less than obvious as the year progressed. The makers of 9-pin dot matrix printers, thought to be dying with the competition from the 24-pin models, fought back with machines at lower prices (albeit with fewer features) to keep market share. Suppliers of 24-pin models, hemmed in at the low end, also had to fend off ink-jet printer rivals. They reacted in two ways. One, they offered feature-rich products at bargain prices—witness the Panasonic and Epson wide-carriage printer models priced below $700. Two, they bundled into their printers software that supports a greater number of type fonts.

Laser-based page printers for desktop use changed in price and functionality during 1989. Until last year, most models produced 8 pages per minute (ppm) and sold above $2,500. But the number of under-10ppm models almost doubled in 1989 to greater than a hundred—including 6ppm models for under $2,000 and 4ppm models for under $1,000. IBM entered the lineup with a new 10ppm model that rivaled market leader Hewlett-Packard Co.'s LaserJet series of printers.

The Big Events in Printers in 1989

IBM and HP square off; and Europe gets printer plants.

- Laser printer revenues surpass sales of impact dot matrix printers for the first time.
- HP's peripherals division surpasses $3 billion in revenue, driven by the explosive growth of its LaserJet family and DeskJet family of nonimpact printers.
- Apple sells its stake in Adobe Systems.
- IBM ups its investments in desktop laser printers. The 4019 LaserPrinter introduced in late 1989 is the first in a family of products that will result in a significant profit stream for the company during the next several years.
- The European Economic Commission's tariffs on Japanese serial, impact and dot matrix printers result in a massive shift in printer production to Europe.

Source: Dataquest Inc.

U.S. Terminal Slump

Although demand for display terminals by customers in Europe and the Pacific Rim was more than enough to offset slumping sales of such peripherals in the United States, the forces pulling down the U.S. terminal market wreaked havoc.

The slowdown in U.S. sales of midrange systems had much to do with the 3% decline in U.S. terminal shipments, which numbered 2.8 million units in 1989. Midrange suppliers—which sell tens, hundreds, even thousands of terminals in some cases, as part of sales of large systems—faced heightened competition from producers of local area networks and powerful desktop systems in 1989. Consequently, their sales of host-based systems—and the terminals attached to them—slumped.

Recovery isn't out of the question for midrange suppliers, if they move toward standardized distributed-computing architectures. They also must provide innovative and attractively priced windowing terminals to take advantage of these systems and their applications.

Independent terminal suppliers, usually able to maneuver through a market slowdown, were severely affected financially by the downturn in the U.S. market. As profitability remained elusive, industry veterans Ampex Corp. and C. Itoh & Co. Ltd. withdrew from the market. Even market leader Wyse Technology, crippled by its ailing personal computer business, found it necessary in 1990 to be acquired by Taiwan-based investment group Channel International to avert a financially bleak future. Other terminal makers such as Esprit Systems Inc. and TeleVideo

The Big Events in Terminals in 1989

A maturing market shows signs of consolidation.

- Midrange systems suppliers get terminal illness.
- Lower terminal prices don't expand demand.
- Channel International (Taiwan) offers to buy Wyse Technology.
- Ampex discontinues its terminal business.
- X-terminals emerge as an important technology.

Source: Dataquest Inc., DATAMATION

X-terminals: new star of stage and screen?

The Top 10 in Peripherals

Laser printers boosted peripheral sales at HP, Canon, Apple and NEC.

	DTM 100 RANK	COMPANY	PERIPHERALS REVENUES 1989 ($MIL.)	1988 ($MIL.)	% CHANGE	MARKET SHARE*
1	1	IBM	10,049.0	11,214.0	-10.4%	18.0%
2	2	Digital	3,200.0	3,166.2	1.1%	5.7%
3	6	Hitachi	2,536.7	2,825.1	-10.2%	4.5%
4	7	HP	2,275.0	1,800.0	26.4%	4.1%
5	4	Fujitsu	2,174.3	2,728.5	-20.3%	3.9%
6	12	NCR	1,989.6	1,872.0	6.3%	3.6%
7	14	Canon	1,956.9	1,772.3	10.4%	3.5%
8	34	Seagate	1,797.0	1,351.0	33.0%	3.2%
9	11	Apple	1,635.6	1,350.0	21.2%	2.9%
10	3	NEC	1,630.7	1,599.7	1.9%	2.9%

* Percentage share of DTM 100 revenues

The Big Events in Storage in 1989

Investment bankers and lawyers mark a busy year.

- Seagate buys Control Data's disk drive subsidiary, Imprimis, giving the company a 41% share of the market for 3½- and 5¼-inch disk drives.
- Writeable CD-ROM drives are shipped.
- IBM announces a magnetic recording density of 1 gigabit per square inch on a 5¼-inch disk drive.
- Domain Technology and Priam file for protection from creditors under Chapter 11 of the U.S. Bankruptcy Act. (MiniScribe follows on January 1, 1990.)
- Archive offers to buy Cipher Data, which would make Archive the largest tape vendor in the world.

Source: Dataquest Inc.

Systems Inc. continued to bathe in red ink, with no rescuer on the horizon.

Industry giant IBM was not immune to the market slowdown; it also suffered a drop in its terminal shipments in 1989, despite setting substantially lower prices for many of its models.

The market has changed. The display terminal market has matured, and growth can be achieved only by focusing on markets tightly defined by either geography, application or both.

For terminal companies to be successful in the 1990s, they must embark on regionalized manufacturing and marketing strategies. Moreover, they must address the display and communications requirements of distributed computing. The winning display terminal products of the '90s will be X-Window terminals—networked, local-processing displays—and alphanumeric terminals with superior ergonomic and user friendly features.

A Storage Revolution?

The worldwide storage industry last year grew less than it had in the previous year, with shipments of disk drives and other storage products expanding less than 30% in most market segments. But the business of making devices that store data was more profitable in 1989 than it was in 1988 for most suppliers.

Higher profitability is good news for users because it means storage suppliers have greater resources to spend on developing products that will be needed in the future.

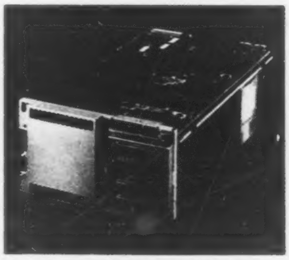
Users may, in fact, be about to witness a revolution in storage technology whereby the recording heads of disk drives actually ride on the surface of (rather than above or alongside) disk platters. Such a breakthrough will ultimately offer disk drives at 20 cents per megabyte from the factory, compared with factory prices of around $2 per megabyte today.

Virtually every major segment of the storage industry is enjoying growth. The worldwide market for rigid disk drives, popular storage devices for personal computers and workstations, expanded 26% to $35 billion in 1989. The global optical disk industry is still in its infancy at $1.1 billion but growing fast. Tape storage products, a $4.8 billion industry, have found a broader range of buyers and some newfound interest by major computer companies.

The 5¼-inch hard disk market began its decline as the 3½-inch drives gained in popularity. First production shipments of new 2½-inch diameter hard drives for notebook computers began in 1989. PrairieTek Corp., Conner Peripherals Inc., JVC Corp. and start-up Areal Technology Inc. are making them. Demand for these tiny drives may expand to more than a million units in 1992. IBM even has shown pictures of a laboratory-produced disk drive that is only 1.8 inches in diameter with 300MB of storage capacity.

Juke boxes are the new rage in optical disc technology. Despite the fact that they don't look anything like the old Wurlitzer in the malt shop of your youth, these mechanical mazes offer many gigabytes of on-line capacity as file servers or archival libraries. Juke boxes are available for write-once magneto-optical, and compact disc read only memory (CD-ROM) optical discs.

Helical scan tape-recording technology, once confined to use in home videocassette recorders, has ventured into the information systems world. Several U.S. and European suppliers are incorporating Japanese-made mechanical-recording decks into their data storage subsystems. Both the 4 millimeter digital audiotape decks and the 8mm Sony video decks are now being used to store computer data on low-cost, pocket-sized cassettes.



Seagate takes the disk drive market by storm.

Such innovation will continue to make storage one of the most interesting segments of the electronics industry. But expect further consolidation among suppliers as the industry continues to mature. Industry giants like IBM and Seagate Technology will be joined by new storage conglomerates. Archive Corp., Conner Peripherals, Hewlett-Packard, Memorex Telex NV and Quantum Corp. are suppliers that might reach the top of the storage elite by the end of the decade. ▭

Greg Blatnick is director of the display terminal industry service for Dataquest Inc. in San Jose; Phil Devin is associate director of Dataquest's computer storage service; and Jim Upham is director of Dataquest's printer service.

DATA COMMUNICATIONS

Networking Suppliers Feel the Pressure

Intensified customer demands for cost-effective connectivity in 1989 led to competitive bulk procurements, renewed interest in outsourcing and the rise of integrated networks.

BY DAVID M. RAPPAPORT

As Ralph Waldo Emerson is given credit for saying, "If you build a better mousetrap, the world will beat a path to your door." While the networking business in 1989 saw vendors trying to live up to their promises and start delivering those better mousetraps, few have had customers beating down their doors.

Vendors in the United States spent 1989 struggling through slack demand and stiff price competition. Internationally, the situation was only slightly better, although the forecast for worldwide communications industry growth is strong, with the European market in particular expected to explode as commercial and political barriers fall. Projections for a nearly doubling of communications equipment sales in Europe by 1993 even become conservative if the Eastern European countries obtain the foreign aid and financing they seek.

1989 caught AT&T in heavy traffic.

Developments in 1989 reflected a continued maturing of both vendors and customers and signaled a new era in customer-vendor relations. Customers faced with tighter budgets and massive investments in existing technology looked for ways to contain costs while meeting the networking demands dictated by increased global competition. All too often, this search was conducted in a poorly defined market crowded with computer manufacturers seeing networking as the panacea for slowing growth and telephone companies jockeying for market share or seeking ways to capitalize on a core business that was rapidly becoming a commodity.

In frustration, customers have started to question whether they are getting the most for their networking dollar. This new, no-nonsense approach has led organizations to reject those vendors that cannot deliver promised products or services that offer cost-effective connectivity while protecting the customer's installed base of equipment. Thus, 1989 ushered in competitive bulk procurements, commonly referred to as Tariff 12s, renewed interest in outsourcing and the acceptance of integrated networks.

Responding to AT&T's cries that MCI Communications Corp. and US Sprint Communications Co. had an unfair advantage because they were not constrained in pricing their services, the Federal Communications Commission authorized a custom network tariff to allow AT&T to be more responsive in competitive situations. The birth of "Tariff 12" triggered fierce price competition among the three major carriers. It also created significant savings opportunities for user organizations willing to put their voice and data networks up for bid. Dozens of companies took advantage of this. Competitive bids will continue through 1990 and for as long as the carriers believe they can use them to secure market share.

The increasingly critical role networking plays in most companies' competitive strategy often strains these firms' ability to effectively implement and operate the resulting environment. In the hope of improving the service while containing costs, several organizations investigated the possibility of outsourcing some portion of their networks' operations and maintenance. This evaluation led Eastman Kodak Co. to issue contracts to IBM, Digital Equipment Corp. and Businessland Inc. IBM has been hired to run Kodak's data centers and System Network Architecture (SNA) networks. Digital will manage the film maker's other voice and data wide area networks. And Businessland will handle its personal computers and local area networks.

Critical Networks

Merrill Lynch & Co. considered turning over the operation of part of its voice and data networking to a team from IBM and MCI, but concluded that the network was too mission critical to allow someone else to operate. Avon Products Inc. also considered outsourcing and, while deciding not to, found the evaluation process to be useful for appraising the effectiveness of its own operation. Responding to this new market opportunity among the vendors were not only Digital, IBM and MCI, but such varied companies as AT&T, the Bell operating companies, Electronic Data Systems Corp. Hewlett-Packard Co. and Westinghouse Electric Corp.

Integrated backbone networks carrying voice and data became the standard at many

Telecom Vendors Reach Out

Price competitive services and the rise of high-speed integrated communications characterize the year.

- The birth of "Tariff 12" triggers fierce price competition among the three major carriers.
- Several organizations investigate, and some initiate, outsourcing of some portion of the operations and maintenance of their corporate networks.
- Reductions in the cost of 1.44Mbps T1 circuits, the greater availability of 2.04Mbps E-1 lines in Europe and the introduction of fractional T1 service make integrated networking more affordable.
- StrataCom introduces the industry's first frame relay interface, which provides sophisticated routing capabilities and lays the groundwork for such emerging packet services as IEEE 802.6 Metropolitan Area Networks.
- High-speed corporate networks and the overall lowering of bandwidth costs promote the resurgence of videoconferencing.
- The LAN market as a whole shows signs of moderating, save for an explosion in the market for 10Mbps Ethernet over unshielded twisted pair wiring.
- All of the value-added network providers announce X.400-based e-mail services and the intention of supporting EDIFACT, the international standard for exchanging EDI messages.

Source: The DMW Group

The Top 10 in Communications

Even though it sold off ROLM, IBM is still the leader in datacom.

	DTM 100 RANK	COMPANY	DATACOM REVENUES 1989 ($MIL.)	DATACOM REVENUES 1988 ($MIL.)	% CHANGE	MARKET SHARE*
1	1	IBM	3,000.0	3,307.0	-9.3%	15.7%
2	17	AT&T	1,445.0	1,250.0	15.6%	7.6%
3	24	NTT	1,355.3	1,018.3	33.1%	7.1%
4	9	Siemens	1,345.7	1,338.3	0.6%	7.0%
5	14	Canon	1,304.6	1,132.3	15.2%	6.8%
6	47	Northern Tel.	1,150.0	900.0	27.8%	6.0%
7	15	Matsushita	906.0	929.1	-2.5%	4.7%
8	33	Ricoh	801.1	850.3	-5.8%	4.2%
9	4	Fujitsu	797.3	816.7	-2.4%	4.2%
10	32	Alcatel	756.4	721.9	4.8%	4.0%

* Percentage share of DTM 100 revenues

corporations by 1989. The biggest reason, of course, was reductions in the cost of 1.44 megabit per second T1 circuits, the greater availability of 2.04Mbps E-1 lines in Europe and the introduction of fractional T1 service, which made such networks affordable for more organizations.

Network Equipment Technologies Inc. continued its dramatic sales growth and remained dominant in the large-backbone switch market while expanding into smaller, entry-level switches and X.25 concentrators.

Sophisticated Routing

StrataCom Inc. introduced the industry's first frame relay interface, which provides sophisticated routing capabilities and lays the groundwork for such emerging packet services as the IEEE 802.6 Metropolitan Area Networks (MANs).

AT&T, with the delivery of AccuMaster Integrator, and IBM, with extensions to NetView, positioned themselves as vendors with the tools required to manage integrated networks. And, as IBM was forming alliances to expand its network management capabilities to encompass LANs and private branch exchanges (PBXs), it concluded the sale of Rolm to Siemens AG. Under the terms of the sale, IBM is continuing to sell Rolm PBXs, but Siemens is controlling development.

Swift Backbones

High-speed corporate networks and the overall lowering of bandwidth costs also promoted the resurgence of videoconferencing. Compression Labs Inc. and PictureTel Corp. together control more than 90% of the U.S. videoconferencing equipment market for sales of systems under $50,000. As corporate networks evolve and the bandwidth of their T1-based facilities are consumed by voice, videoconferencing and LAN connectivity, users' need for even higher speed backbones is evident. Network Equipment Technologies and Infotron brought 45Mbps T3 multiplexers to market in response to these growing requirements. The trend also prompted both AT&T and Northern Telecom Ltd. to announce support for the SONET multiplexing standard in their central office switching equipment. Their move encouraged others to support the scheme, which is based on fiber optic transmission operating at speeds in multiples of 30Mbps up to 1 gigabit in both long-haul and campus networking.

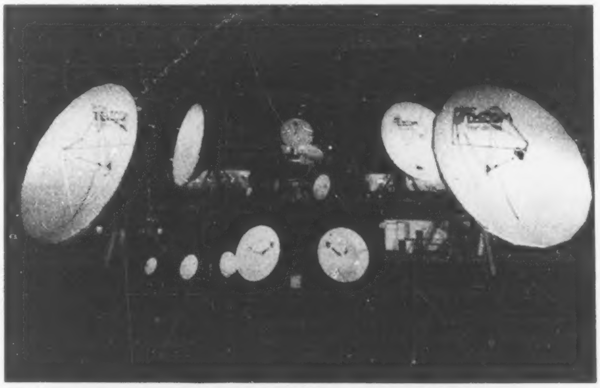
The LAN market as a whole showed signs of moderating in 1989. Despite continued growth in the sales of LAN operating systems and adapter boards, both leading independent LAN companies, Novell Inc. and 3Com Corp., had lower than anticipated sales. Although Novell's sales increased by more than 20%, many analysts expected its growth in 1989 to be higher. Synoptics Communications Inc. was able to take advantage of an explosion in the market for 10Mbps Ethernet over unshielded twisted pair wiring by capturing about 70% of sales and forcing others, like 3Com, to respond quickly.

What's Hot

The hottest sellers were LAN/WAN bridges, routers and gateways, as organizations struggled to connect their islands of technology. Despite most vendors' concerns over diverting resources from their longer term development efforts in connection with the Open Systems Interconnection protocol, acceptance continued of the Transmission Control Protocol/Internet Protocol (TCP/IP) standard as the multivendor connectivity protocol set. Among those enhancing their TCP/IP support was IBM with software for its OS/2 PC operating system, thereby offering a TCP/IP implementation for each of its major operating systems.

Significant activity also occurred among the value-added network providers during 1989. British Telecommunications PLC purchased McDonnell Douglas Corp.'s Network System Group, including Tymnet, and announced plans to merge Tymnet and Dialcom services. AT&T moved into the value-added market in the United Kingdom by acquiring Istel, a networking spinoff of the Rover Group. MCI strengthened its position both internationally and in data communications by acquiring Computer Sciences Corp.'s remaining 25% holding in Infonet, the other equity partners in Infonet being the Post, Telephone and Telegraph services (PTTs) from Europe and Asia. All of the value-added network providers announced X.400-based electronic mail services and the intention of supporting EDIFACT, the international standard for exchanging EDI messages. ▭

David M. Rappaport is with The DMW Group, an international network integration consulting firm in Ann Arbor, Mich.



British Telecom searched the globe for acquisitions.

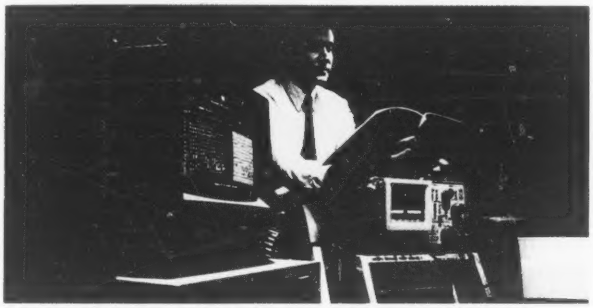
SOFTWARE

Software Stays at The Cutting Edge

Software vendors eagerly embraced vanguard technologies in 1989, delving aggressively into UNIX, cooperative processing and object-oriented programming.

BY HARVEY L. POPPEL

Last year was another year of change and consolidation for the software industry. Feeling its age and the heat from less than robust hardware sales, the industry grew only 15%, failing for the first time in several years to achieve the 20% growth rates more characteristic of immature markets.



France's Cap Gemini brings savoir faire to the desktop.

The consolidation caravan, however, continued to pick up speed. Topping the list of most significant takeovers in 1989 were Cullinet Software Inc., which was captured by Computer Associates International Inc., and Management Science America Inc., which was bought out by Dun & Bradstreet Corp.

Major developments in the areas of UNIX, networking, object-oriented programming, computer-aided software engineering (CASE) and microsystems utilities helped shape the software market in 1989.

In contrast to the more reluctant hardware vendors, most software suppliers have been eager to embrace UNIX. Last year that eagerness turned to optimism as suppliers' hopes for a single UNIX standard hit an all-time high. But that optimism was dampened when a true standard was not put forth by either the Open Software Foundation or UNIX International Inc.

Despite that disappointment, the heightened visibility of UNIX among software developers resulted in a plethora of new products, some in such nontraditional areas as securities-trading systems and computer-integrated manufacturing (CIM). More powerful networking software can now link UNIX workstations that had formerly operated in the stand-alone mode.

The networking software that made its way onto the market last year falls into two groups: cooperative processing (or client/server computing) and enterprisewide network management. Recently introduced applications such as OfficeVision from IBM, All-in-1 Phase II from Digital Equipment Corp. and Object Office from Data General Corp. are first steps in the evolution of cooperative processing. In addition, Ashton-Tate Corp., IBM, Ingres Corp., Novell Inc. and Oracle Corp. are among the companies working on Structured Query Language (SQL)-type database products upon which applications will be developed.

Vital Tools

The need to run increasingly complex and intertwined networks has fueled demand for enterprisewide network management tools. Those tools are vitally needed because users can no longer cope with the islands of automation that require them to separately monitor isolated network management packages for such elements as mainframes, local area networks (LANs), multiplexers, T1 switches and private branch exchanges (PBXs).

Throughout last year, the likes of AT&T, Digital, Hewlett-Packard Co. and IBM continued to aggressively market their network management products, jockeying for the coveted position of "manager of managers." Nevertheless, by year's end, all of the sundry network management products—from IBM's Systems Network Architecture (SNA) offering, NetView, to products based on the Open Systems Interconnection (OSI) standard—fell far short of the goal of providing complete centralized monitoring and control capabilities. So, until the mid-1990s, most users will probably have to resort to their own staff or third-party systems integrators to tailor vendor products to satisfy their network management requirements.

Lotus 1-2-3, take 3.

An Object Orientation

A slew of new product announcements in 1989 set the stage for object-oriented programming (OOP) to evolve during the '90s into the preferred programming environment for commercial applications. Although the OOP concept has been around since the 1970s, actual products have been scarce and limited to complex scientific and engineering applications.

Today, cooperative processing and multimedia systems have introduced another form of complexity into the computing equation. That complexity, which is not adequately addressed by current development environments and database systems, can be well served by object-oriented programming, which can meet both user and vendor needs for software that is easy to use, modular, extendable, portable and reusable.

Indeed, the benefits of OOP are compelling. The programming style shortens de-

The Software Scoop

1989 featured software companies eagerly embracing new technologies.

- Vendors introduce a plethora of UNIX products, some in nontraditional areas like securities trading and CIM.
- First steps are taken toward the development of cooperative-processing software with IBM's OfficeVision, Digital's All-in-1 Phase II and DG's Object Office.
- A slew of new product announcements sets the stage for object-oriented programming to evolve into the preferred programming environment for commercial applications.
- IBM introduces its AD/Cycle applications development environment, thus confirming de facto standards in the fragmented CASE market.
- New e-mail, file transfer, menu systems and shells add sparkle to the microsystem utilities market.

Source: Broadview Associates

Top 10 in Software

	DTM 100 RANK	COMPANY	SOFTWARE REVENUES 1989 ($MIL.)	1988 ($MIL.)	% CHANGE	MARKET SHARE*
1	1	IBM	8,424.0	7,927.0	6.3%	34.3%
2	4	Fujitsu	1,449.5	1,456.4	-0.5%	5.9%
3	44	CA	1,290.2	705.4	82.9%	5.2%
4	3	NEC	1,065.4	1,085.5	-1.8%	4.3%
5	5	Unisys	875.0	875.0	0.0%	3.6%
6	2	Digital	825.0	794.6	3.8%	3.4%
7	50	Microsoft	820.8	610.8	34.4%	3.3%
8	6	Hitachi	724.8	680.1	6.6%	2.9%
9	9	Siemens	638.3	626.4	1.9%	2.6%
10	7	HP	600.0	500.0	20.0%	2.4%

* Percentage share of DTM 100 revenues

velopment cycles and improves software maintenance. It also helps provide users with access to data that are carried on increasingly distributed multiplatform networks.

OOP products fall into four basic categories: operating systems, programming languages, user interfaces and databases. This breakdown is reflected in the products that were introduced last year, suggesting that the major software vendors are going after the OOP market on all four fronts. The most hotly contested battles, however, will be fought on the database management system (DBMS) arena.

Relational DBMS (RDBMS) suppliers will undoubtedly adopt the object-oriented database approach over the next few years. This will be good news for users, since object-oriented DBMSs will allow them to integrate a variety of data types—everything from procedures [illegible] images and voice. This capability makes OOP an ideal choice for the multimedia systems era of the '90s.

During 1988 and 1989, the established DBMS vendors, led by California vendors Sybase Inc. of Berkeley and Informix Software Inc. of Menlo Park, began adding object-oriented features to their RDBMSs. Others, like Oracle, are attempting to incorporate these features into their offerings by enhancing their data manipulation languages.

Another technology destined to help the software development process is CASE. Last September, IBM set the stage for the further evolution of this technology when it unveiled its AD/Cycle. With the announcement, IBM signalled its willingness to stand behind AD/Cycle as the de facto applications development standard in the fragmented CASE market.

IBM's investments in CASE companies Bachman Information Systems Inc., Index Technology Corp. and KnowledgeWare Inc. attest to just how costly and complex the technology can be to develop. These equity stakes also indicate Big Blue's fear of gambling on a solo effort to develop a full suite of life cycle products.

Microsoft's headquarters is the center of the desktop software universe.

Pioneers in PC Utilities

Firms such as Fifth Generation Systems Inc. and Peter Norton Computing Inc. probably knew that they weren't taking much of a gamble when they set out several years ago to pioneer the microsystems utility segment of the software market. That segment was given legitimacy when Ashton-Tate and Lotus Development Corp. rolled out their utility wares.

Utilities either facilitate the use or enhance the performance of hardware, software or peripherals. At the PC level, there are programs for file managers, communications, and program restoration and backup. New products and whole new product categories began to surface last year to satisfy the needs of the microcomputer environment.

CA's Wang to cultivate Cullinet.

There were electronic mail programs such as cc: Mail from cc:Mail Inc., file transfer software such as Laplink from Traveling Software Inc. and menu systems typified by Direct Access from Delta Technology International Inc. Network diagnostic and DOS shell products were also popular, as was antivirus detection and repair software. ▭

Harvey L. Poppel is a partner at Broadview Associates, a leading IT merger and acquisitions firm in Fort Lee, N.J. He was assisted with the article by the firm's associates.

SERVICES/MAINTENANCE

Service Providers Expand Their Horizons

Service and maintenance providers are beefing up their offerings in response to changing IS appetites.

NORMAN G. LITELL AND RICHARD MUNN

The world of information services no longer revolves around small, niche players. Instead, the sun is shining on a new world populated by providers offering a much broader range of services aimed at meeting more diverse and complex customer needs.

Maintaining Customers in 1989

The customer is king to maintenance vendors.

- Hardware maintenance still accounts for 75% of the business.
- As hardware becomes more reliable, vendors expand into other areas, such as site preparation and construction, systems integration, service coordination and network management.
- Software support is seen as a key area of expansion by maintenance firms.
- Maintenance companies begin to design custom service strategies account by account.
- As maintenance companies become more customer oriented, prices come down.

Source: The Ledgeway Group

Those needs are a reflection of the key issues and trends that promise to influence the services market for the next several years. Strides in certain technologies are changing the way data ownership and processing capacity are distributed, both physically and organizationally. Some of those major advances are coming in the areas of voice/data networking, distributed and relational database management systems, workstations and imaging.

To integrate these evolving technologies into existing systems requires hardware and software standards. Today, one of the main value-added features that a systems integrator provides is the ability to develop a solution connecting multiple technologies, applications and data structures. Such system complexity is causing service vendors to broaden their range and expertise.

Some vendors are also broadening the actual scope of their business through mergers and acquisitions, moves that are consolidating the services industry. The Big Eight accounting firms have been compressed into the Big Six, and many smaller, specialty firms have been melded into larger companies looking to expand their functional and vertical-industry muscle. IBM has also been spreading its wings, going after minority stakes in software and systems integration companies.

All in all, there has been a blurring of the distinctions between traditional product and services markets. Some vendors focus on specific industries, some base their offerings on certain technologies, while others serve only select hardware platforms. These specializations are expected to continue in the years ahead.

ADP helps integrate personnel and payroll.

Photograph by Camille Vickers

How's Everybody Doing?

Also expected to continue in the services market over the next five years is an overall compound annual growth rate of 16%, according to the Mountain View, Calif.-based market research firm Input Inc. Contributing to that healthy growth will be the five segments of the services market—processing services, systems operations, network services, systems integration and professional services—which together pulled in $51 billion in 1989.

The $16 billion processing services segment is the slowest growing area of the market. To boost their business, the larger and more sophisticated vendors are branching out into software, systems integration and turnkey systems.

Also at $16 billion, the professional services sector is fast becoming a two-tiered market. Large-scale integrated firms are evolving to tackle customized applications for large clients and projects. And small firms that support small clients with standardized applications are springing up, thanks to the increased availability of workstations, local area networks and applications packages.

Computer Sciences Corp.

The older and larger processing and professional sides of the business are expanding at a much more sluggish clip than the newer and smaller systems integration and network services markets. The fastest growing segment, systems integration, which accounted for $6 billion in revenues last year, is predicted to pull in $17 billion by 1994.

Network services is the second fastest growing segment. The increased availability and connectivity of networks has helped vendors ease into this service arena. They are providing a wider and more flexible range of services that leverage their network capabilities and databases. Today, the majority of this market is accounted for by on-line information services.

Increasingly, both systems integration and systems operations are being handled by the same vendor. That's because contracts for systems integration work often lead to long-term pacts for systems operations. The hottest topic in today's $6 billion systems operations realm is outsourcing. The outsourcing deal be-

meets customers needs.

tween IBM and Eastman Kodak Co. announced late last year brought a new sense of legitimacy to an old and sleepy business.

Beefed-up Services

Like their counterparts in IS services shops, companies engaged in customer service—those that have earned their bread and butter by catering primarily to maintenance needs—are also beefing up their menu of à la carte offerings. In addition to maintenance, the firms in this fast-changing field are being forced to provide a fuller and more eclectic menu because the pickings are steadily getting slimmer on the more traditional maintenance side of the business.

The one staple that has carried these vendors the furthest the longest, though, is hardware maintenance. In 1989, hardware maintenance accounted for 75% of the $55.2 billion in revenues which were gobbled up by hungry customer service vendors, according to The Ledgeway Group of Lexington, Mass. By 1994, that percentage is expected to shrivel like a piece of bacon on a hot frying pan to 61%. Much of that shriveling is due to the simple fact that hardware is becoming more reliable. In fact, major hardware makers will soon be promising mean time between failure rates of 15 years on their products.

Bringing Home the Bacon

Destined to bring home more of the bacon in this market, therefore, will be a mixture of services in new spheres such as site preparation and construction, systems integration, service coordination and network management. Customer service providers continued to move further into these spheres, at the same time edging into the same areas that the IS services vendors were exploring last year, in an attempt to respond to customers' appetites for a more varied diet of IS support.

Some of that support came in the area of software. Under that software support umbrella, service firms helped clients set up user help desks and run data centers, networks and even mailrooms on a contract basis.

User demand is fueling this diversification into new professional services, which are predicted to generate $7.2 billion by 1994. There's already evidence that firms in the field are tailoring their offerings to the newfound needs of their customers. They're designing custom service strategies, account by account. They're establishing partnerships with other service shops to provide more complete services for clients. And they're meeting and managing customer expectations with regard to systems availability. Gone are the days when customers were nailed with annual service contracts that amounted to 12% of the list price of their equipment. Finally, the customer services pendulum has swung toward the customer. ▭

Norman G. Litell is director of the market analysis program at Input Inc. of Mountain View, Calif. Richard Munn is president of The Ledgeway Group, a division of San Jose-based Dataquest Inc.

In Service in 1989

The players come out of their niches.

- Technologies are changing the way data ownership and processing capacity are distributed.
- Hardware/software standards increase in importance.
- Vendors broaden their businesses through mergers and acquisitions, which causes a consolidation in the number of vendors in the market.
- The line between the product and service markets becomes blurred.
- The increasing complexity of systems causes service vendors to broaden their range and expertise.

Source: Input Inc.

The Top 10 in Maintenance

Price cutting and competition in maintenance are putting a lid on growth.

	DTM 100 RANK	COMPANY	MAINTENANCE REVENUES 1989 ($MIL.)	1988 ($MIL.)	% CHANGE	MARKET SHARE*
1	1	IBM	7,036.0	7,347.0	-4.2%	24.0%
2	2	Digital	3,300.0	3,212.0	2.7%	11.3%
3	7	HP	2,000.0	1,742.0	14.8%	6.8%
4	5	Unisys	1,947.0	1,971.0	-1.2%	6.6%
5	12	NCR	1,647.0	1,678.6	-1.9%	5.6%
6	8	Groupe Bull	1,228.4	1,374.7	-10.6%	4.2%
7	21	Wang	994.0	829.4	19.8%	3.4%
8	9	Siemens	957.4	968.1	-1.1%	3.3%
9	10	Olivetti	902.6	929.6	-2.9%	3.1%
10	20	Xerox	850.0	800.0	6.3%	2.9%

* Percentage share of DTM 100 revenues

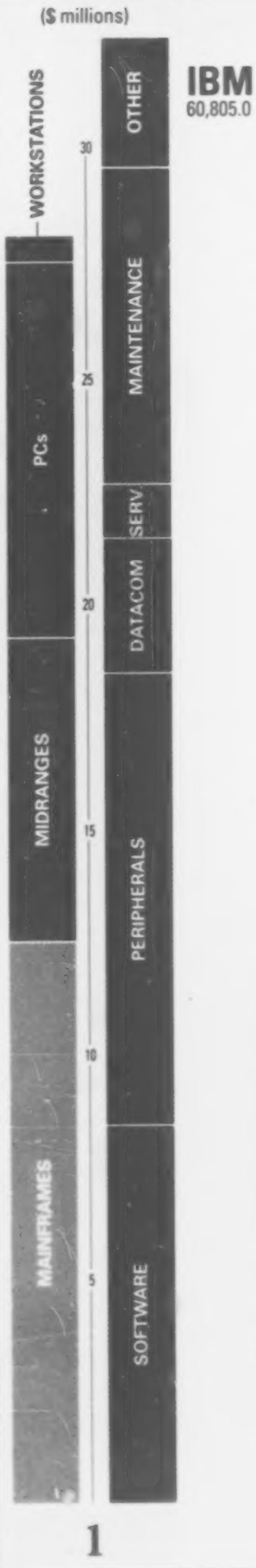
The Top 10 in Services

EDS, Andersen Consulting and IBM post strong growth in revenues.

	DTM 100 RANK	COMPANY	SERVICES REVENUES 1989 ($MIL.)	1988 ($MIL.)	% CHANGE	MARKET SHARE*
1	23	EDS	2,477.9	1,907.6	29.9%	11.0%
2	36	ADP	1,689.5	1,617.0	4.5%	7.5%
3	38	TRW	1,565.0	1,533.0	2.1%	7.0%
4	41	CSC	1,442.8	1,253.4	15.1%	6.4%
5	2	Digital	1,386.7	1,100.0	26.1%	6.2%
6	45	Andersen	1,225.7	945.7	29.6%	5.5%
7	1	IBM	1,200.0	935.0	28.3%	5.3%
8	48	Cap Gemini	1,103.4	976.5	13.0%	4.9%
9	24	NTT	898.7	675.6	33.0%	4.0%
10	5	Unisys	825.0	825.0	0.0%	3.7%

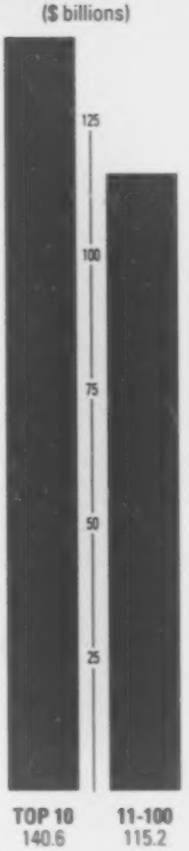
* Percentage share of DTM 100 revenues

THE DATAMATION 100

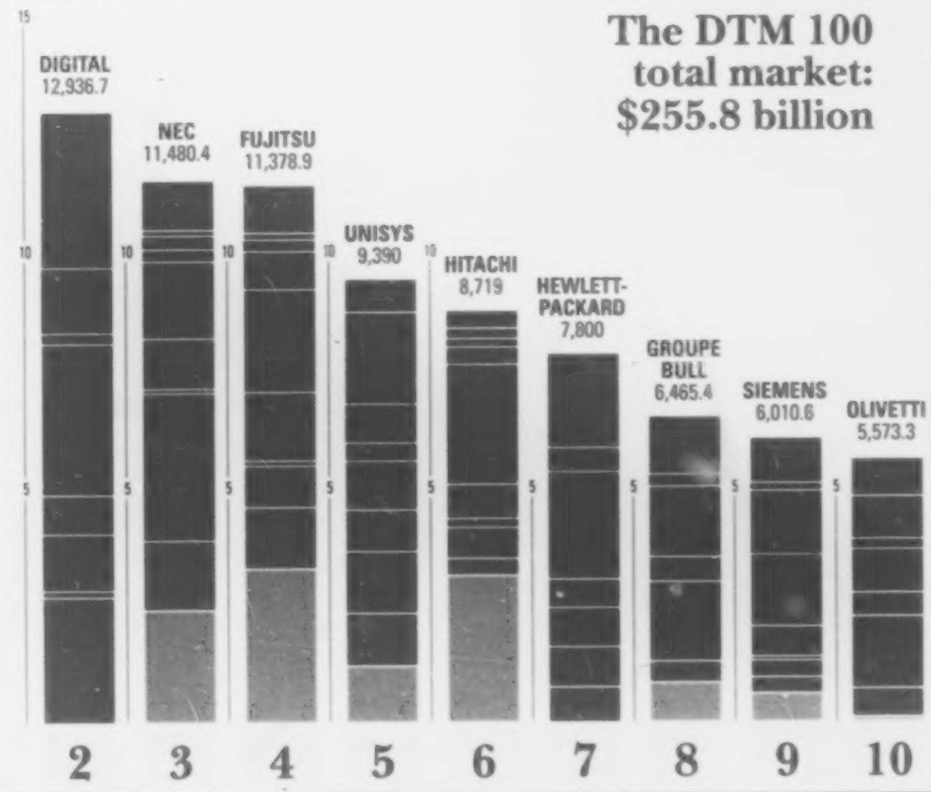


IBM accounts for almost 25% of the DTM 100 market. As a group, the top 10 make up 55%, with four from North America, three from Europe and three from Asia.

TOP 10 COMPANIES



The DTM 100 total market: $255.8 billion



THE DATAMATION 100

RANK	COMPANY	1989 TOTAL IS REVENUE	MAIN-FRAMES	MID-RANGES	PCs	WORK-STATIONS	SOFT-WARE	PERI-PHERALS	DATA-COM	SERVICES	MAINTE-NANCE	OTHER
1	IBM	60,805.0	12,509.0	6,753.0	8,343.0	591.0	8,424.0	10,049.0	3,000.0	1,200.0	7,036.0	2,900.0
2	Digital	12,936.7		2,670.0	135.0	1,195.0	825.0	3,200.0	225.0	1,386.7	3,300.0	
3	NEC	11,480.4	2,391.8	1,471.3	3,116.5	87.0	1,065.4	1,630.7	253.7	289.9	434.9	739.3
4	Fujitsu	11,378.9	3,261.5	1,304.6	869.7	108.7	1,449.5	2,174.3	797.3	253.7	326.1	833.5
5	Unisys	9,390.0	1,200.0	1,122.0	1,300.0		875.0	1,039.0	375.0	825.0	1,947.0	707.0
6	Hitachi	8,719.0	3,116.5	362.4	652.3	181.2	724.8	2,536.7	362.4	181.2	434.9	166.7
7	Hewlett-Packard	7,800.0		750.0	850.0	825.0	600.0	2,275.0	500.0		2,000.0	
8	Groupe Bull	6,465.4	840.5	452.5	1,681.0		517.2	1,487.0		258.6	1,228.4	
9	Siemens	6,010.6	611.7	345.7	351.1	79.8	638.3	1,516.0	1,345.7	164.9	957.4	
10	Olivetti	5,573.3	105.6	607.0	1,523.4		497.7	917.0	216.7	0.0	902.6	803.3
11	Apple	5,372.3			3,574.2		162.5	1,635.6				
12	NCR	5,319.0	183.4	475.0	333.0		125.0	1,989.6	141.0	425.0	1,647.0	
13	Toshiba	4,595.1		978.4	1,340.8	116.0		942.2	746.5	0.0		471.1
14	Canon	3,783.3		14.5	145.0			1,956.9	1,304.6		362.4	
15	Matsushita	3,663.7			145.0	800.8		1,594.5	906.0		217.4	
16	Compaq	2,876.1			2,876.1							
17	AT&T	2,865.0		150.0	700.0		75.0	150.0	1,445.0	145.0	200.0	
18	NV Philips	2,814.8		353.6	443.2		117.9	947.7	457.4		396.1	99.0
19	Nixdorf	2,792.6	117.0	425.5	191.5		372.3	1,196.8	159.6	31.9	297.9	
20	Xerox	2,790.0				325.0	90.0	1,025.0	400.0	100.0	850.0	
21	Wang	2,697.0		570.0	430.0		100.0	493.0	80.0	30.0	994.0	
22	STC	2,643.4	466.1	318.9	81.8	114.5	327.1	248.0	81.8	424.6	490.7	90.0
23	EDS	2,477.9								2,477.9		
24	NTT	2,254.0							1,355.3	898.7		
25	Nihon Unisys	2,112.7	422.6	260.8	218.7		587.3	475.4			147.9	
26	Amdahl	2,101.0	1,470.8				42.0	252.1	63.0		273.1	
27	Sun	2,062.5				1,443.8	103.0	309.4			206.3	
28	Memorex	2,056.6			196.2			1,177.1			401.4	281.8
29	Mitsubishi	2,025.7	166.7	456.6	217.4			670.4	514.6			
30	Oki	1,952.0		72.5	85.5		140.6	1,137.2	322.5		193.5	
31	Tandy	1,892.0			1,330.0		75.0	382.0			105.0	
32	Alcatel	1,800.3			124.4		87.0	744.3	756.4		88.1	
33	Ricoh	1,799.5			287.5		90.8	438.7	801.1		90.8	90.8
34	Seagate	1,797.0						1,797.0				
35	CDC	1,691.0	465.0				100.0	751.0		56.0	320.0	
36	ADP	1,689.5								1,689.5		
37	Tandem	1,676.8		709.6		50.0		460.0	150.0	25.0	282.2	
38	TRW	1,643.0								1,565.0	78.0	
39	Prime	1,520.0		525.8			90.0	300.0			604.2	
40	Seiko Epson	1,449.5			579.8			869.7				
41	CSC	1,442.8								1,442.8		
42	C. Itoh	1,345.9				471.1	94.2	621.1	50.7	108.7		
43	Data General	1,296.5		245.9		40.0	40.0	540.0			430.6	
44	CA	1,290.1					1,290.2	0.0				
45	Andersen	1,225.7								1,225.7		
46	Nokia	1,191.9		119.2	396.4	93.3	23.8	93.3	189.4	160.0	116.6	
47	Northern Telecom	1,150.0							1,150.0			
48	Cap Gemini	1,103.4								1,103.4		
49	Storagetek	982.5						710.5			272.0	
50	Microsoft	952.8					820.8	52.0				80.0

Revenue figures are in millions of dollars.

THE DATAMATION 100

RANK	COMPANY	1989 TOTAL IS REVENUES	MAIN-FRAMES	MID-RANGES	PCs	WORK-STATIONS	SOFT-WARE	PERI-PHERALS	DATA-COM	SERVICES	MAINTE-NANCE	OTHER
51	Commodore	866.5			866.5							
52	Intergraph	860.1		60.0		260.0	125.0	126.3			228.6	60.0
53	Motorola	860.0		160.0			25.0		500.0		175.0	
54	Mannesmann	819.1		286.7				409.6			122.9	
55	Intel	812.0			812.0							
56	Cray	784.7	633.6				12.9				138.0	
57	Oracle	769.3					554.3			215.0		
58	General Electric	740.0								550.0	190.0	
59	Amstrad	717.0			717.0							
60	Conner Peripherals	704.9						704.9				
61	3M	696.4						631.4		65.0		
62	British Telecom	692.5							332.4	360.2		
63	Black & Decker	687.6								687.6		
64	Finsiel	662.5					391.5			271.0		
65	American Express	660.0								660.0		
66	Lockheed	590.0					80.0	360.0		30.0	120.0	
67	Texas Instruments	585.0		125.0			55.0	265.0		20.0	120.0	
68	Racal	573.9							573.9			
69	Comparex	566.0	181.1					294.3			90.6	
70	Lotus	556.0					516.0			40.0		
71	SHL	539.8			287.2		33.8			201.9	16.9	
72	CSK	520.0	16.0	78.1			310.1	4.7		14.3		96.8
73	Martin Marietta	502.2								502.2		
74	NYNEX	495.0					178.0			317.0		
75	Acer	493.7			377.8			42.8	13.3			
76	AST Research	482.0			398.1				25.8			58.1
77	Science Applications	479.0					239.0			240.0		
78	Wyse	452.3			195.0			200.0				57.5
79	Dun & Bradstreet	450.0					450.0					
80	Ernst & Young	450.0								450.0		
81	Maxtor	447.2						447.2				
82	Kodak	445.0					35.0	270.0		10.0		130.0
83	SD-Scicon	431.5		50.2						381.3		31.9
84	Novell	429.9					287.6		98.6		43.0	
85	Mentor	426.4					333.9				92.5	
86	Alps	420.4						420.4				
87	3Com	413.9				107.5			82.7			223.6
88	Everex	402.0			227.8			174.2				
89	Sligos	400.7					8.9			385.5	6.3	
90	MAI Basic Four	397.0		119.0			55.0	63.0			142.0	18.0
91	Quantum	394.2						394.2				
92	Shared Medical	390.0		145.0						245.0		
93	Dell	388.6			307.0			81.6				
94	Mitac	380.0	5.7	28.5	178.6			133.0			36.0	
95	Sema Group	378.6					378.6					
96	Tandon	377.9			377.9							
97	Kyocera	366.4			145.0			145.0	72.5			
98	Boeing	359.2								359.2		
99	Norsk Data	358.1		198.0			29.1				131.0	
100	Concurrent	344.6		237.8							106.8	

The suppliers in dominant positions are those that know how to apply information technology and deliver it via networks to users. Watch out for Sony and Sun, Cap Gemini and Intel.

An Age of Applications and Networks

If timing is, indeed, everything in life, DATAMATION's scheduling couldn't have been any better for an interview with Robert J. Conrads on what the 1990s hold in store for us. On the morning we sat down to interview Conrads, the mergers and acquisition chief for First Boston Corp. thought he had just completed the industry's first big deal of the new decade. (It unraveled weeks later.)

"Have you heard about the Lotus-Novell merger?" Conrads asked us shortly after we arrived at First Boston's Park Avenue headquarters in New York City. Thinking that the M&A chief wanted to start the interview off on the lighter side, we immediately asked him for the punch line. "It's no joke," he said of the proposed marriage between Lotus Development Corp. and Novell Inc. And he went on to elaborate about why such a union of financial equals makes sense. It was a serious start to a very serious conversation with Conrads about the future of the industry—a 90-minute dialogue, excerpts from which you see here.

Our conversation covered a range of companies, including U.S. suppliers AT&T, Compaq Computer Corp., Computer Associates International Inc., Cray Research Inc., Digital Equipment Corp., General Dynamics Corp., Hewlett-Packard Co., Intel Corp., Lotus, McDonnell Douglas Corp., Microsoft Corp., Motorola Inc., NCR Corp., Novell, Poqet Computer Corp. and Supertech; European suppliers Cap Gemini Sogeti, Groupe Bull, Hoskyns Group Ltd., Ing C. Olivetti & Co. SpA, NV Philips' GL, Sema Group, Siemens AG and Sligos; and Japanese suppliers Fujitsu Ltd., NEC Corp., Okigawa Electric and Sony Corp.

Conrads' vision of information technology is one shaped by

BY JOE KELLY AND TIM MEAD

knowledge and experience. He spent his undergraduate and early graduate years as a Yellow Jacket, earning bachelor's and master's degrees in atomic physics from the Georgia Institute of Technology. He picked up a master's degree in business administration at Harvard University before joining McKinsey & Co., a management consulting firm whose electronics practice he headed. From McKinsey, he joined Kidder, Peabody & Co. He then switched investment banks, choosing to ply his M&A trade at First Boston.

Q: The most frequently mentioned subject in the magazine's conversations with users and suppliers is talk of a major change under way in the information technology industry—away from computing on hosts toward doing so in a client/server environment. Do you see such a change? If so, what impact will it have on the world's top 100 suppliers?
A: What's going on is very similar to the change that we had when we went from mainframes to minicomputers. If you go back to the late 1960s, it was thought that the only real computing that could be done was at the mainframe level. Digital and some others destroyed that notion. As technology enabled more robust implementation of applications on smaller boxes, all of a sudden applications that no one had ever dreamed of were running on computers in the mid- to late-1970s.

The same thing is already happening in microcomputers. And it will continue to evolve to the point where a mainframe acts as a server, a traffic cop, a number cruncher. The real computing—particularly the application interface, which is becoming more complex—will occur at the local level.

The local environment is not just a microcomputer. It's a network where you can move a lot of intelligence [information] around at any given instant.

Q: The single biggest trend evident in this and previous years' DATAMATION 100 data is that demand for information technology (IT) is growing much more rapidly in Europe and the Pacific Rim than in the United States. What are your thoughts on the subject?
A: The base of information systems installed in the United States is a lot larger. When you look at absolute dollar increases in the amount users are spending on computers, the U.S. market is still quite substantial. Also, recognize that the United States is always three to five years ahead of Japan and Europe.

The real growth curve in computer spending that we saw in the United States in the early 1980s is just now hitting Europe and Japan. They're investing in technology that allows them to do a lot of things that they hadn't been able to do in the past.

Q: Do you expect that the indigenous suppliers in the Pacific Rim and Europe will capture most of the information technology growth in those regions, or do you see U.S. companies getting their fair share?
A: I think that U.S. suppliers are going to get their fair share. But in Japan, in particular, I think we're going to see local suppliers in partnership with U.S. companies—not to just extract technology, but to build the distribution infrastructure needed to do business in Japan and the rest of Asia.

Q: Can you give an example of something happening in Japan right now that evidences that change?
A: Cray Research's purchase of Supertech. Supertech has a relationship with Okigawa Electric, whereby it serves as the Japanese distributor for its supercomputing products. That's the kind of thing you'll see in the future. And a lot of U.S. companies—particularly software producers—that haven't been in the Asian market are looking for ways to penetrate it. Knowing that applications are so important, they realize they must have local talent and local knowledge [to be successful there].

Q: Who will win the battle for the information technology budgets of European users?
A: Europe is a horse of a different color because U.S. suppliers are much more comfortable there. They've been there longer. They've made a lot of inroads in that market. . . . That isn't going to change. I think that you're going to see Japanese companies working through local European entities to gain more of a share of the market. But it's going to be a slow, hard road for Japanese suppliers—really hard.

Q: So you see much stiffer competition for Europe's premier suppliers?
A: Absolutely. . . . Companies like Siemens and Olivetti are going to have to develop much better channels of distribution for information technology as the 1992 phenomenon really picks up momentum. They are going to have to establish themselves in a much broader context in Europe than just within their national borders.

Q: How much momentum does Western Europe really have?
A: It's going to be a very high growth market. But the 1992 phenomenon is not going to be a light switch that comes on. It's occurring now and will build momentum through 1996, 1997, 1998 or whenever. By the late 1990s, the economics of Europe are going to be fairly transparent through the major countries. And the big players will be present in most markets by the end of the decade.

Q: One thing European and Japanese suppliers seem to have going for them in competing against U.S. companies are regional or national industrial policies. Are U.S. suppliers at a disadvantage?
A: On any given Monday morning, yes, they can be. Are U.S. suppliers in all cases? Not necessarily, because sometimes the policy is so vague that it allows a supplier enough room to maneuver to be competitive. In some cases, that brings the best competitive actions out of the company in the United States or its subsidiaries around the world. . . .

U.S. policy, for all intents and purposes, is: Anything that can succeed is in. The fact of the matter is that the Europeans and the Asians can't as readily supply software, which is driven by application knowledge, as companies in the United States can. So that's where U.S. suppliers

Suppliers That Will Make a Difference

European, Japanese and U.S. companies that are poised to make a contribution to the industry in the 1990s

COMPANY	STRENGTHS & CHALLENGES
European Suppliers	
Cap Gemini	Well positioned to deliver application solutions
Groupe Bull	Currently a force, but government subsidization is questionable
Olivetti	Good strategy and execution, but enough resources?
Siemens	Must develop much stronger presence in Europe outside of West Germany
Japanese Suppliers	
NEC	Strong customer base, understands importance of bringing the technology into the customer's business
Sony	Understands miniaturization
U.S. Suppliers	
AT&T	Strong customer base, understands importance of bringing the technology into the customer's busi-ness
Compaq	More in sync with users than some other suppliers that are trying to force-feed users with technology
Computer Associates	Software
Hewlett-Packard	Smart in bringing technology to market
Intel	Drives the processing capability that will enable users to run new, critical applications
IBM	Strong customer base, dominant player, willing to reexamine itself, understands importance of bringing the technology into the customer's business
Microsoft	Software
Sun	Important on the engineering side and in the whole

are successful. They also are enjoying success on the hardware side. Let's not forget that IBM, a U.S. company, still dominates computers.

Q: Returning to the issue of how much faster IT spending is growing outside the United States than within it, are U.S. users placed at a disadvantage by the fact that their European and Asian rivals in the last few years have consumed much more leading-edge products than those available in the United States in the early 1980s?
A: U.S. users are much smarter about applications because they got involved with applying information technology to their businesses much earlier on. . . . And to a large degree—with open systems and standards coming in now, and with a lot of applications software being ported into these new open environments—U.S. users will be able to keep up on a price-performance basis with the Europeans or the Japanese.

Q: Since you brought up the subject, how much of a factor will open systems be in the 1990s? And why should users care about them at all?
A: Open systems are happening. Suppliers are paying attention to UNIX. They are porting to UNIX. They are developing applications on UNIX. And UNIX is going to be a real force. But the concept of customer control is still extremely important, and what IBM and Digital and others are doing is figuring out other ways where they can add value to differentiate their open products—keeping them in effect proprietary suppliers to their customers. . . .

Standard interfaces give the customers more confidence to take greater risks, including bringing in new IT suppliers. That means that the dominant players are going to have to do more than just sell the users one time. They're going to have to continue to sell and support them, trying to add value all the while. That's going to accelerate the number of applications that we see out in the [end-user] environment.

Q: Switching back again to competition, suppliers often liken their market to a playing field. Is it a level or uneven one?
A: There are major imbalances. And the reason that there are major imbalances is that more and more of this business is becoming applications driven. If, for example, you have a software package that works great in pharmacies in Canada, it doesn't necessarily work great in pharmacies in the United States. The application knowledge is so crucial in that indigenous market that local companies—whether owned internationally or locally—are going to have an advantage because they can relate to the customers. They can embody the applications for those customers in a product or system that the customers can use.

Q: Applications seem to be a new element of competition. Years ago, wouldn't you have measured competitiveness in terms of which regions of the world had the best technology infrastructure, interest rates, etc.?
A: I don't want to de-emphasize the upstream technologies and their effect long term. As time goes on, you are going to see more and more of the software and application knowledge embedded in silicon [the base material for semiconductors, the brains of most computers]. As a supplier, if you don't have the silicon or access to it, you are going to be at a real disadvantage because miniaturization is one of the big drivers of new applications of information technology. Suppliers must keep reducing the footprint [physical size] of their systems and devices within them. And the way they can do that is by getting more of their software embedded in the silicon.

Q: Where do U.S., European and Japanese suppliers stand in regard to silicon and other competitive areas?
A: In terms of just raw output of silicon, we all know the answer to that—it's all in Japan. In terms of the knowledge incorporated in that silicon, it resides in the United States and Europe—particularly in the United Kingdom, where there are extremely good software development tools.

The breakthrough in software development is going to be akin to the breakthrough of going from a transistor to an integrated circuit. . . . Once we get a robust set of CASE [computer-aided software engineering] tools, a software developer won't have to write a million lines of code for an application. With the right CASE tools, all a developer would have to do is come up with 100 concepts, which a cogenerator can then turn into the million lines of code. They, in turn, can be translated into silicon, which is going to take a hundredth of the space that it takes up today. And that is what we are looking at in the decade of the 1990s. I think it's going to be that dramatic.

Q: When are we going to see this drama unfold?
A: There are going to be some major breakthroughs in software between 1993 and 1995—maybe sooner. . . .

The software and silicon developments also have implications for our communications systems because the way you are going to make applications more robust is by feeding them with more information. You have to be able to increase your bandwidth to feed information into the system, to process it and then move it back out so it can be useful. That, in turn, has implications on what our telecommunications networks are. . . .

All these things are going to make their impact, in the course of the mid-1990s . . . when we still see applications that we can hardly even imagine today—multimedia applications, large international data transfers, etc.

Q: What role will niche players have in the world of integrated applications that you describe? Are major systems companies like NCR, Hewlett-Packard and others going to ride roughshod over suppliers focused on single markets?
A: I think it's still way too early to tell. Compaq, for example, has found a very successful niche for itself in upgrading the capabilities of analysts and secretaries by bringing computing power to the desktop in a way that works the user. The customer will continue to buy Compaq if, for example, it continues to solve problems.

Q: Are you saying that users of information-technology will continue to support the small players as well as the big ones?
A: Yes. And even Compaq is even moving toward a systems [as opposed to single-user] approach. It would argue, I think, that it's moving at the pace that users are moving. As users' applications requirements go up, Compaq is more in sync with them than some other suppliers that are trying to force-feed users with technology they don't need.

Q: Is it easier for small suppliers to move upstream technologically as users' applications needs grow than it is for big-iron companies to move downstream?
A: The supplier who is going to win is the one that pays attention to the customer—figuring out where it can add value to [customers'] applications. That can be a systems guy or a box guy. But a supplier can't just have sales and marketing driving the technology, because you will never get there from here. A supplier must have an integrated approach to solving users' problems where the technologists get involved and they, in some cases, force-feed a little bit of technology to users.

Q: The leading company in the industry, IBM, often boasts of being in the solutions business. How do you think IBM will perform in the next few years?
A: IBM is taking a lot of heat . . . and has been for the last couple of years. It is, by all measures, still a dominant company in the industry—not just domestically but also in Europe and even in Japan. It is a company that has an extraordinary customer base. And it is one that is struggling with how to deal with the evolution of the market. . . .

IBM will continue to live and do well. But it's going to go in some different directions . . . It will continue to reexamine what it is and where it is going. But it's going to continue to be a very viable competitor.

Is Outsourcing Here to Stay?

Outsourcing is a topic being given increasing attention by top information systems executives worldwide. They want to know whether they should consider farming out critical IS functions to service providers. Here are Conrads' thoughts on the subject.

Q: Is outsourcing here to stay?
A: It's going to be slow to start but accelerate once several large companies do it successfully. You're going to find CEOs asking their IS directors: "Why can't we do it?"

Q: Is outsourcing a good business for an IBM or a Digital to be in?
A: Given Digital's culture and their mentality, it is going to be a big leap to get into that business—on its own . . . because outsourcing really is a different way of thinking about your business. Outsourcing is a different way of serving your customer, a different way of helping your customer think about its business. That's what makes some of these outsourcing suppliers so successful—they won't touch hardware unless it's part of the services they offer, and most don't really want to sell packaged software.

Q:Are you seeing an outsourcing in Europe or Japan?
A: In Europe, Hoskyns, Cap Gemini, Sligos and Sema are all in a position of being able to do so. But outsourcing isn't as well accepted in Europe as it is in the United States, though Cap Gemini has done a very good job in some cases with this.

Q: What should IS directors do about outsourcing? Should they embrace it as a solution to their problems? Should they try to spin out their own IS operations to form outsourcing units?
A: If you are going to create your own outsourcing business within your enterprise, it has to be an explicit strategic move that is endorsed by your parent company. . . . That's a tough decision. A lot of companies like McDonnell Douglas and General Dynamics—ones that built large data centers in the '60s and '70s to support large projects—looked at entering what today we call the outsourcing business pretty hard. In most cases, they decided not to do so. Those that did . . . haven't really kept up with the times.

Q: Other than IBM, what information-technology suppliers stand out in your mind as being positioned to make a major contribution to the IS strategies of users in the 1990s?

A: Thinking about this question from silicon up through systems and communications, I'd begin with Intel. On the semiconductor side, it's going to be a powerhouse—maybe along with Motorola. But if I had to choose one or the other, I would tend to go with Intel. It's going to drive the processing capability that will enable users to run new, critical applications.

Moving into systems, I think companies like Sun are very adaptable—even though it had a bit of a downer in its growth. Sun is going to be very important on the engineering side and in the whole workstation field. . . .

I also like Sony in that regard, because I think it is looking for a way into this whole market. These guys [who run Sony] are awfully smart. . . . They have the resources to join the [information technology] party—not only at the silicon level, but also at the product level.

Q: Do you think a company with a consumer orientation such as Sony will be in a better position to deliver the sorts of easy-to-use computer interfaces demanded by information-technology customers in the 1990s than industrially focused suppliers?

A: Yes. Sony also understands miniaturization and its effects on interfaces. . . . Sony is looking at the world from a different angle than IBM or AT&T. . . .

The Hewlett-Packard/Apollo combination also is very powerful. It's much smarter about bringing technology to market [than it used to be]. . . . It has the resources to be a player.

Q: Are you speaking of financial or human resources?

A: Both. You know, you've got to have both to be a player in this market. You have to have the resources to be able to talk to the customer and service his needs on a regular basis so he knows that you're paying attention to him. That's something that a lot of these world-class players like HP have.

Q: Who catches your eye in software and in bigger systems?

A: Microsoft is going to continue to be a force in this market. . . . So could Computer Associates.

On the large systems side, companies like NEC, AT&T, IBM—while some view them as giants that kind of slowly move along—have the staying power. They have the customer base, and they understand the importance of bringing the technology into the customer's business.

Q: Do any small supplier companies capture your attention?

A: My characterization of who's going to be around and who's going to be important tends to focus on larger companies. But that's not to say that there aren't going to be start-ups with whiz-bang products that emerge from places like Silicon Valley.

But as DATAMATION's readers make systems-oriented decisions and the impact they have on their organization's strategies, there are some suppliers whose directions they had better understand. Those are the players I'm describing.

Q: There's no European supplier on your list of companies likely to play a major role in the 1990s. Why?

A: Three that can be forces worldwide are Siemens, Philips and Cap Gemini.

Q: How about Olivetti and Bull?

A: Olivetti has got a transition to get through. It has a good business strategy, and I think its execution is pretty good. [It's just a question of whether Olivetti has the resources to accomplish everything.]

Groupe Bull is being subsidized by the French government. And whenever you have that kind of a situation, as a user you wonder when some government administration might change its mind [about staying in the information technology business]. . . . Right now, Bull is a force in the market.

Q: What are going to be the characteristics of the chief executive officer capable of leading an information technology supplier through the 1990s?

> **☐ IBM AND DIGITAL WILL FIGURE OUT WAYS TO DIFFERENTIATE THEIR OPEN PRODUCTS.**

A: It's got to be somebody who is capable of taking risks, of pulling teams together and, yet, be hard-nosed about the decisions that have to be made as the company goes through various stages and as the environment changes around it.

In information technology, bear in mind, there are more variables changing at a faster rate than in any other industry. Technology is changing. Customer needs are changing. Capital availability is changing. Competition is changing—competitors can come out of the woodwork to challenge a CEO. And channels of distribution are changing. . . .

Such variables require a senior management team to be able to make decisions, try a variety of new things, do more of what works and do less of what doesn't work. Moreover, the team must make those decisions fairly quickly, . . . and have the resources available so that it can afford to make a mistake or two. If you're operating on a very thin balance sheet, you just don't have the resources available to make a mistake.

Q: What are chief executive officers of information technology suppliers telling you about their strategies for the 1990s?

A: A lot of CEOs are concerned about survival today. They don't know exactly how to position their companies to survive this discontinuity. The ability to capture the technology in a product and manufacture and market it on an economic scale throughout the world is becoming much more awesome. . . .

The thing that is on everybody's mind is consolidation.

Q: What will be the major trends in mergers and acquisitions for information technology suppliers in the 1990s?

A: Suppliers that merge will compliment each other either in their distribution channels, products, technologies or geographies. They will come together on a truly equal basis to create much broader-based competitors than previously existed.

Q: Are we likely to see mergers between companies from different regions of the world or within them?

A: We're going to see both types. One thing becoming more prevalent is this notion of IBM or Japanese suppliers taking equity positions in a company as opposed to buying the whole company. The reason is not just economic. It's to preserve the culture . . . of that company. You're going to see more of it because if you have equity participation between two suppliers, you have a true strategic partnership.

Q: Does intermediate integration—as some people describe these equity arrangements—make more sense for major players like IBM and Hitachi and Siemens than it does for smaller companies?

A: It makes sense for all size companies for different reasons. You can go down to the real small companies like Poqet Computer, for example, which got a big infusion from Fujitsu—30% or 40% of the equity. . . . Or you can look at big companies like IBM. IBM's investments give it access to new technology and channels that it didn't have before. And equity positions leave IBM's options open, giving it time to figure out how to shape its business over time.

Q: Are you bold enough to say that, if we think we've seen consolidating in the past, we ain't seen nothing yet?

A: Yeah. I'm bold enough to say that—particularly in the middle market. . . . You're going to see much more of a bimodal distribution of companies in the United States five or six years from now in information technology. . . .

I think you're going to have it in Europe as well, because economies of scale are necessary to take advantage of opportunities created by 1992 and by events in Eastern Europe.

Q: Can users judge these companies by just some of the financial numbers? When we look at companies, should we look for higher research and development as a percentage of sales? Or are these numbers really not valid as a judging point?

☐ THE BREAKTHROUGH IN SOFTWARE WILL BE AKIN TO GOING FROM A TRANSISTOR TO AN IC.

A: Not entirely. The percentage of sales devoted to research and development, for example, is relative to how big a supplier's sales are and how many things it is spreading research investments across. A medium-sized company spreading its R&D dollars across too many things is much worse off than a small one focused on the product area customers are most interested in.

These percentages are flags. If a supplier is spending 1% or 2% on R&D and one of its sales representatives is telling you, the user, what a great new product set is coming down the road, you should be pretty skeptical. On the other hand, if a supplier is spending 10% on R&D, you had better understand exactly where that's being spent. It may be taking off in a direction that's not important to the user at all.

Or if a supplier's revenue per employee is way up, you should ask whether the company is squeezing back on its infrastructure costs so much that it may be unable to support customers in the future. . . .

Pay attention to return on capital investment, which answers the question: How good is a supplier at getting the capital needed for a job and being successful at employing that capital? If a supplier is consistently good at that, it's a winner. That's what causes some suppliers—like HP, Intel and others—to stand out. Intel, which is in a business that uses up cash, is good at maintaining profit margins on its new products and playing out its old products to generate the cash needed to invest in the R&D and new capital equipment needed to stay more than competitive.

Q: Looking beyond the 1989 financial performance of the industry's top 100 companies, do you see the industry growing year to year throughout the 1990s?

A: There is going to be growth. It's not going to be as explosive as it was just because the base today is bigger. . . . Worldwide, year-to-year growth will be 7 to 8% for the next five years. . . . There's still a lot of juice left here, in my view. We're not even approaching the limits of the core technologies that drive this industry—silicon, software and communications.

I can't emphasize enough what impact new networks are going to have on the industry. The supplier that can provide local area networks to a user and help the user with applying those LANs is going to be in a preferred position. That supplier is going to be channeling software. The supplier is going to probably be developing front-end [hardware or software] to match the user's applications. . . .

Being able to move large volumes of information at high speeds and compute with such information in real time is going to just leapfrog the applications. Practically speaking, right now we cannot do high-volume, real-time processing because we don't have the bandwidth to do so. But we ain't far away.

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